

## **Appendix**

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**Appendix A**  
**List of Designated CPR Focal Points**

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## **Appendix B**

### **Federal Register, May2, 1997, NPRM**

Pages 24287 through 24303 has the preamble for the Type Certification Procedures for Changed Products. It begins on the next page.



Federal Register: May 2, 1997  
(Volume 62, Number 85) Page  
24287

## DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 21 and 25

[Docket No. 28903; Notice No.  
97-7]

RIN 2120-AF68

### Type Certification Procedures for Changed Products

**AGENCY:** Federal Aviation  
Administration (FAA), DOT

**ACTION:** Notice of Proposed  
Rulemaking (NPRM)

14 CFR Parts 11, 21, and 25

**SUMMARY:** This document  
proposes to amend the  
procedural regulations for the  
certification of changes to type  
certificated products. The  
amendments are need to address  
the trends toward fewer products  
that are of completely new  
design and more products with  
repeated changes of previously  
approved designs. Safety would  
be enhanced by applying the  
latest airworthiness standards, to  
the greatest extent practicable,  
for the certification of design  
changes of aircraft engines, and  
propellers.

**DATES:** Comments must be  
received on or before September  
2, 1997.

**ADDRESSES:** Comments on  
this proposal must be mailed in  
triplicate to: Federal Aviation  
Administration, Office of the  
Chief Counsel, Attention: Rules  
Docket (AGC-200, Docket No.  
28903, 800 Independence  
Avenue SW, Washington, DC  
20591, or delivered in person to  
room 915G at the same address.  
Comments may also be  
submitted electronically to the  
following Internet address: 9-

NPRM-CMTS@faa.dot.gov.  
Comments submitted must be  
marked: Docket No. 28903.  
Comments may be inspected in  
room 915G weekdays, except  
Federal holidays, between 8:30  
am and 5:00 pm.

FOR FURTHER  
INFORMATION CONTACT:  
Lyle C. Davis, Certification  
Procedures Branch (AIR-110),  
Aircraft Certification Service,  
Federal Aviation  
Administration, 800  
Independence Avenue, SW,  
Washington, DC 20591,  
telephone (202) 267-9588.

### SUPPLEMENTARY INFORMATION:

**Comments Invited:** Interested  
persons are invited to participate  
in the proposed rulemaking by  
submitting such written data,  
views, or arguments as they may  
desire. Commenters should  
identify the regulatory docket or  
notice number and submit  
comments in triplicate to the  
Rules Docket at the address  
specified above. All comments  
will be considered by the  
Administrator before action on  
the proposed rulemaking is  
taken. The proposals contained  
in this notice may be changed in  
light of the comments received.  
All comments will be available  
in the Rules Docket, both before  
and after the closing date for  
comments, for examination by  
interested persons. A report  
summarizing each substantive  
public contact with Federal  
Aviation Administration (FAA)  
personnel concerning this  
rulemaking will be filed with the  
docket. Commenters wishing the  
FAA to acknowledge receipt of  
their comments must submit  
with those comments a self-  
addressed, stamped postcard on  
which the following statement is  
made: "Comments to Docket No  
28903". The postcard will be

dated and time stamped and  
returned to the commenter.

**Availability of NPRMs** An  
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communications software from  
the FAA regulations section of  
the Fedworld electronic bulletin  
board service (telephone: 703-  
321-3339), the Federal  
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board service (telephone: 202-  
512-1661), or the FAA's  
Aviation Rulemaking Advisory  
Committee Bulletin Board  
service (telephone: 202-267-  
5948).

Internet users may reach the  
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<http://www.faa.gov> or the  
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[http://www.access.gpo.gov/  
su\\_docs](http://www.access.gpo.gov/su_docs) for access to recently  
published rulemaking  
documents.

Any person may obtain a copy  
of this NPRM by submitting a  
request to the Federal Aviation  
Administration, Office of  
Rulemaking, ARM-1, 800  
Independence Avenue SW,  
Washington, DC 20591; or by  
calling (202) 267-9680.  
Communications must identify  
the notice number or docket  
number of this NPRM.

Persons interested in being  
placed on the mailing list for  
future NPRM's should request  
from the above office a copy of  
Advisory Circular No. 11-2A,  
Notice of Proposed Rulemaking  
Distribution System, that  
describes the application  
procedure.

### Background

#### *Statement of the Problem*

Under the regulations in effect  
prior to the early 1940's, an  
applicant for a change product,  
such as an alternate engine  
installation, was required to

apply for a new type certificate and comply with the standards current at the time of application. This did not present an unreasonable burden on the applicant then because the airworthiness standards did not change appreciably over short periods of time. That is, the standards current at the time of an application were essentially the same as those with which the original product had to comply. Since the early 1940's, however, rapid changes in technology have resulted in significant changes in the airworthiness standards over relatively short periods of time. Therefore, an applicant for an extensive change to a type certificated product, which required a new type certificate, could be faced with complying with safety standards that varied considerably from the standards for the original product. To relieve this situation, the FAA's predecessor agency required an application for a new type certificate only if the change was quite extensive.

In recent years, a trend has developed towards fewer products that are of such significantly new design that a new type certificate is required. In many cases, over a period of time, a series of changes could permissively be made to a product by amending its original type certificate such that the resultant model is substantially different from the original model. Although each changed product in such a series of changes may differ little from its immediate predecessor, the changes could collectively result in a product with substantial differences from the original product. As a result, many newly manufactured aeronautical products are not being required to comply with the more recent airworthiness

standards. The procedural regulations need to be changed to correspond with this trend toward fewer new type certificates.

#### **History of Type Certification.**

Title 49 U.S.C. Sec. 44701 authorizes the FAA Administrator to promote safety of flight of civil aircraft in air commerce by prescribing and revising minimum standards governing the design and construction of aircraft, aircraft engines, and propellers as may be required in the interest of safety, and such minimum standards governing appliances as may be required in the interest of safety.

Under 49 U.S.C. Sec. 44704, the FAA may issue type certificates, including supplemental type certificates, for aircraft, aircraft engines, and propellers. The FAA may prescribe in any such certificates the duration of the certificate, and the terms, conditions, and limitations as required in the interest of safety.

The general certification procedures for products (aircraft, aircraft engines, and propellers) and parts are set forth in 14 CFR part 21 (part 21). As described in Secs. 21.13 and 21.15, any interested person may apply for a type certificate by submitting an application accompanied by the required documentation to the FAA. Sections 21.16 through 21.21, 21.101, and 21.115 specify certain regulations and designate the applicable airworthiness standards for type certification of both new and changed products.

Section 21.17 designates the applicable regulations for the issuance of type certificates. In order to be issued a type certificate, the applicant must show that the product complies

with the airworthiness standards contained in one of the following 14 CFR parts, as applicable; part 23 for normal, utility, acrobatic, and commuter category airplanes; part 25 for transport category airplanes; part 27 for normal category rotorcraft; part 29 for transport category rotorcraft; part 31 for manned free balloons; part 33 for aircraft engines; part 35 for propellers; and part 21 (Sec. 21.17 (b) and (f)) for special classes of aircraft and primary category aircraft respectively.

The airworthiness standards in these parts of the regulations may be amended as needed to reflect continually changing technology, correct design deficiencies, and provide for safety enhancements. An applicant for a type certificate is required under current Sec. 21.17, with certain exceptions, to show that the product meets the applicable airworthiness standards that are in effect at the date of the application. The exceptions include instances in which the Administrator specifies otherwise or in which the applicant either elects or is required under specific circumstances to comply with later effective amendments. In addition, the Administrator may prescribe special conditions.

Under Sec. 21.16, special conditions may be prescribed if the Administrator finds that the existing airworthiness standards do not contain adequate or appropriate safety standards because of novel or unusual design features of the product to be type certificated relative to the design features considered in the applicable airworthiness standards. Also, under Sec. 21.21(b)(1), if any applicable airworthiness standards are not complied with, an applicant may nevertheless be entitled to a type



certificate if the Administrator finds that those standards not complied with are compensated for by factors that provide an equivalent level of safety. Such determinations are commonly referred to as "equivalent safety findings" and are made with respect to the level of safety intended by the applicable standard. In addition, under Sec. 21.21(b)(2), an applicant may be denied a type certificate if the Administrator finds an unsafe feature or characteristic of the aircraft for the category in which type certification is requested, even though the aircraft may comply fully with the applicable airworthiness standards.

Taken together Secs. 21.16, 21.17, and 21.21 designate the applicable airworthiness regulations for type certification and accommodate those circumstances when the airworthiness standards do not adequately cover the design features of a product. These sections recognize and balance the following four important considerations:

- (1) The obligation of the FAA, under 49 U.S.C. Sec. 44701, to keep the airworthiness standards required in the interest of safety, (i.e., parts 23, 25, 27, 29, 31, 33 and 35) as current as practicable;
- (2) The type certificate applicant needs to know, early in a certification program, what the applicable airworthiness standards will be in order to finalize the detailed design of its product and to enable the applicant to make reasonable performance guarantees to its potential customers;
- (3) In the interest of safety, rapid technological advances presently being made by the civil aircraft industry necessitate that the FAA be able to issue special conditions to address

novel or unusual design features that it has, as yet, not had an opportunity to address in the airworthiness standards through the general rulemaking process, or to address novel or unusual design features that were not considered by the appropriate airworthiness standards applicable to changes to type certificates; and

(4) To allow flexibility in design. Wherever possible, the airworthiness standards of 14 CFR Chapter 1, subchapter C, are intentionally objective in nature, and the procedural regulations permit design changes over the operational life of a product.

Originally, the FAA would issue special conditions informally as an interpretation of the "no unsafe feature or characteristic" regulations; however, in 1967, the FAA formalized the process with the adoption of Sec. 21.16. As provided in that section, special conditions are issued as regulations in accordance with public comment provisions of 14 CFR part 11 (part 11). The adoption of Sec. 21.16 extended the special condition process to include aircraft engines and propellers.

The provision in Sec. 21.21(b)(2), that a type certificate would be issued for an aircraft only if no unsafe feature or characteristic existed, remained unchanged.

The phrase "novel or unusual" is used in describing design features for the issuance of special conditions under the provisions of Sec. 21.16. These design features involve a state of technology not considered for the applicable airworthiness standards at the time they were written; in some areas, the state of the regulations may lag the state of the art of new designs.

This disparity is due to both the rapidity in which the state of the art is advancing in civil aeronautical design and the need to develop a sufficient experience base with new technology before proceeding with general rulemaking. Therefore, there may be instances in which special conditions are required for design features considered "state of the art" in the aircraft industry. Conversely, many new design features that might be thought of as "novel or unusual" in the context of the product's original certification basis may already be covered by existing regulations, thereby obviating the need to issue special conditions. This fact is recognized in existing Sec. 21.101(b)(1).

For example, in 1980, the holder of a small airplane type certificate who installed turboprop engines in place of reciprocating engines did so by complying with appropriate later regulations. Because appropriate regulations were available for the installation of turboprop engines, special conditions were not issued for installation of the engines. These changes were made through the FAA issuing an amendment to the type certificate originally issued in 1964. The airworthiness regulations, part 23, were changed to accommodate turboprop engines in 1969.

Special conditions are not issued for general upgrading of the applicable airworthiness standards to achieve a higher level of safety. Whenever the FAA concludes that a compelling need exists for a higher level of safety in type designs, rulemaking is proposed in accordance with the general rulemaking procedures of part 11, the Administrative

Procedure Act, and Executive Order 12866. Finally, Secs. 23.2, 25.2, 27.2, and 29.2 provide retroactive regulations in the airworthiness standards. A complete statement of the FAA intent with respect to the application of special conditions is found in the preamble to amendment 51 to Part 21 (45 FR 60154, September 11, 1980). That intent is in no way changed by the proposals herein.

Sometimes new airworthiness standards contain provisions that, in the interest of safety, should be applied retroactively to existing aircraft. Typically this is accomplished by proposing changes to 14 CFR parts 121 and 135, and sometimes part 91, through rulemaking procedures.

#### **History of Type Certification of Changes**

Part 21 designates the applicable airworthiness standards for changed products. Section 21.19 describes the circumstances in which an applicant for type certification of a changed product must apply for a new type certificate. Prior to the early 1940's, an applicant for a changed product, such as an airplane with an alternate engine installation, was required to apply for a new type certificate. The regulations in effect prior to the early 1940's required an applicant for a changed product to apply for a new type certificate for a change such as an alternate engine installation. When a new type certificate was required, the applicant had to comply with the standards current at the time of application. This did not present an unreasonable burden on the applicant then because the airworthiness standards did not change appreciably over a period of time. The then current standards were, therefore,

essentially the same as those with which the original product had to comply. Later, more rapid changes in technology resulted in significant changes in the airworthiness standards over relatively short periods of time. An applicant for a type certificate for a changed product could thus be faced with complying with airworthiness standards that varied considerably from those with which the original product complied. In some instances, the differences in standards could be so great that an applicant would be discouraged from making any changes, including changes that would, in themselves, contribute to the safety of the product. To relieve this situation, by the early 1940's, an application for a new type certificate was required only if the change was extensive.

Section 21.19(a) requires a new type certificate when a change is considered so extensive that a substantially complete investigation of compliance with the regulations is required. In addition, Secs. 21.19 (b), (c), and (d) provide specific types of changes that require an application for a new type certificate because those types had already been determined to be substantial per Sec. 21.19(a). For a normal, utility, acrobatic, commuter, or transport category aircraft, paragraph (b) requires a new aircraft type certificate if the proposed change is (1) in the number of engines or rotors, or (2) to engines or rotors using different principles of propulsion or to rotors using different principles of operation. Similarly, paragraph (c) requires a new engine type certificate if the proposed change is in the engine's principle of operation, and paragraph (d) requires a new propeller type certificate if the proposed change is in the

number of blades or in the principle of pitch change operation.

The basis for Sec. 21.19(b)(1) originated in the early 1950's following the issuance of an amended type certificate to an applicant who altered a popular single-engine, four-passenger, light airplane into a twin-engine model. Although that conversion was approved by an amendment to the original type certificate, the agency recognized that the conversion from one to two engines added considerable complexity to the airplane and greatly affected its handling characteristics. Therefore, the predecessor of Sec. 21.19(b)(1) was adopted requiring a new type certificate for a change in the number of engines or rotors. The regulatory language was broad enough in scope to include any change in the number of engines or rotors whether such changes would simplify or add complexity to the type design.

The FAA does not require an applicant to apply for a new type certificate to add small auxiliary engines to an aircraft. In the 1960's with the development of small turbojet engines to be used as auxiliary engines, the FAA defined a jet engine that develops less than 50 percent of the static thrust developed by one of the primary propulsion engines as an auxiliary engine. The FAA considers the "number of engines" as used in Sec. 21.19(b)(1) to refer to the number of primary propulsion engines and not to any auxiliary engines to be installed. The FAA has issued a large number of exemptions from the regulation concerning a change in the number of engines.

Prior to 1957, predecessors of current Sec. 21.19(b)(2) stated that an applicant must make a

new application for type certificate if the proposed change was to engines employing different principles of operation or propulsion. This meant that an applicant desiring to replace reciprocating engines with the same number of turbopropeller engines would have to apply for a new type certificate. During that period, it was recognized that considerable advances in safety, reliability, and passenger comfort could be realized by replacing reciprocating engines in certain transport category airplanes with turbopropeller engines. In order to encourage such beneficial changes, the reference to different principles of operation was deleted in 1957 for transport category airplanes. As a result, an applicant may be granted approval for a conversion of this nature without applying for a new type certificate providing the applicant complies with certain later standards applicable to turbine-powered airplanes. In the broadest sense, all powered airplanes achieve propulsion by accelerating a mass of air and/or exhaust gases. In the narrower context of Sec. 21.19(b)(2), however, "principles of propulsion" means propeller-driven versus turbojet.

Section 21.19(b)(2) also states that an applicant must make a new application for a type certificate if the proposed change is to rotors employing different principles of operation or propulsion. The FAA is not aware of any instance in which this specific section was the basis for requiring an application for a new type certificate; any change of this nature, together with all related changes, would have been so extensive that a new type certificate would have been

required under the provisions of Sec. 21.19(a).

The FAA has never granted any exemptions from the regulation for a new aircraft type certificate for a change to engines or rotors using different principles of propulsion. Similarly, no exemptions have been granted from the engine or propeller type certificate regulations for changes involving the principle of engine operation, for changes in the number of propeller blades, or for changes in the principle of pitch change operation.

Under Sec. 21.101, the original type certificate may be amended to include changes to the product when the applicant demonstrates that it complies with the same airworthiness standards as the original product plus appropriate special conditions, and the change does not warrant making a new application for a type certificate under Sec. 21.19. Because Sec. 21.101 (a) and (b) are incorporated by reference in Sec. 21.115, these procedures are equally applicable to persons applying for supplemental type certificates.

Section 21.101(a) requires that an applicant for a change to a type certificate must comply with either the regulations incorporated by reference in the type certificate or the applicable regulations in effect at the date of application, plus any other amendments the Administrator finds to be directly related. The "regulations

incorporated by reference" are the regulations that were the certification basis for the original issuance of the type certificate. They are frequently referred to as the "original certification basis".

If an applicant chooses to show compliance with the regulations in effect at the date of the application for the change, the applicant must also comply with any other amendments that are directly related. In some instances, a regulation may be amended to become less stringent, but a related regulation may become more stringent. In a situation of this nature, the applicant must also comply with the related compensating regulation as well. Current Sec. 21.101(a) does not otherwise require compliance with later amendments and does not grant the Administrator the authority to require compliance with later regulations as a method to increase the level of safety of a product.

An applicant for a change to a type certificated product is responsible for showing that the entire product, as altered, not just that the change itself, complies with the certification basis, because areas that have not been changed may be affected by the change. However, the applicant need not resubstantiate those areas of the product where the original substantiation has not been invalidated by the change.

Section 21.101(b) pertains to changes for which the regulations incorporated by reference do not provide adequate standards. Such changes generally involve features that were not envisaged at the time the regulations incorporated by reference were adopted and are, therefore, novel or unusual with respect to those regulations. For these changes, the applicant must comply with regulations in effect at the date of application for the change as found necessary to provide a level of safety equal to that established by the regulations

incorporated by reference. In this case, the applicant is not able to select any amendment of the regulation it chooses between those incorporated by reference and those in existence at the date of the application. When regulations in effect at the date of application for the change fail to provide adequate standards, the applicant must comply with special conditions to provide a level of safety equal to that established by the regulations incorporated by reference.

### **Trends in Type Certification of Changes**

In recent years, a trend has developed toward fewer products that are of completely new designs, which would require new type certificates. Over a period of time, a series of changes to an original product may have been made so that the current model is substantially different from the original model. Although each changed product in such a series of changes may differ little from its immediate predecessor, the changes could result collectively in a product with substantial differences from the original product.

For example, one model originally manufactured as a normal category airplane with two reciprocating engines has been changed through a series of alterations to incorporate turbopropeller engines, a stretched and heightened fuselage, a tricycle landing gear, a modified wing planform and a 42 percent increase in maximum takeoff weight. In this particular case, the majority of changes were made through the FAA's issuing supplemental type certificates to modifiers other than type certificate holder. However, the type certificate holder could have made the

same incremental changes without applying for a new type certificate each time.

In another instance, a type certificate holder effected significant changes in the design of a turbojet transport category airplane without obtaining a new type certificate by making a series of changes to its existing type certificate. Each incremental change, by itself, was determined not to be so extensive as to require a new type certificate under Sec. 21.19(a). This airplane evolved into a configuration approximately 40 percent greater in fuselage length and with a 92 percent greater maximum takeoff weight than the original model. These changes, which have been incorporated into newly manufactured airplanes, are possible because the FAA issued amendments to the type certificate.

Another trend in manufacturing is to keep products in production over several decades. Some currently manufactured transport category airplanes have, for example, evolved from airplane models originally type-certificated 25 years ago. This does not imply that those airplanes are "unsafe," because they do, in practice, have features that address the intent of most of the current airworthiness standards. However, current procedural regulations (part 21) do not require that changed products comply with the current airworthiness standards.

The basic premise behind the FAA's current policies for the procedures and airworthiness standards for type certification is that the highest possible degree of safety in the public interest, should be achieved by products being certificated at any given

time. In dealing with this premise, the FAA has had to continually weigh the desire for the highest level of safety with the cost to the manufacturers, operators, and traveling public for achieving that highest possible degree of safety in the public interest. This balance between safety and cost has been exacerbated by the introduction of highly sophisticated products whose development and manufacture have become enormously expensive. This is one reason why, as stated before, manufacturers choose to produce more and more changed products that, by the FAA regulations, are not required to have new type certificates.

The FAA maintains that the issue should not be whether a product is produced under a new type certificate or an amended one. The issue is whether or not the level of safety of the product, embodied in the airworthiness standards it complies with, is as high as practicable. In addition, to require areas unaffected by the change to comply with the later standards is not only unreasonably costly but may reduce the level of safety of the product due to unforeseen developmental problems. The manufacturers are constantly issuing service information that describes approved alterations that users may make to improve the level of safety of the product. Thus, it is common place that products in service today possess a level of safety significantly greater than that embodied in their certification basis.

When establishing the highest practicable level of safety for a changed product, the FAA has determined that it is appropriate to assess the service history of a

product as well as the later airworthiness standards. It makes little sense to mandate changes to well understood designs, whose service experience has been acceptable, merely to comply with new standards. The clear exception to this premise is where the new standards were issued to address a deficiency in the design in question or where the service experience is not applicable to the new standards. This consideration of airworthiness standards and service experience should form the basis for developing the certification basis for a change in a product.

It can be argued, for consistency, that new airworthiness standards should apply across the board to the entire aircraft fleet; however, application of new standards would not be practicable in every case. Although newly designed aircraft are required to meet all applicable current airworthiness standards, in many cases a product being changed, for which only an amended type certificate is needed, is required to meet only the standards referenced in the original type certificate. Thus, there may be a considerable difference between the standards required for a new product and for a product undergoing change. A product undergoing change that met the applicable standards at the time of original type certification is not currently required to meet more current airworthiness standards except in those instances where retroactive regulations have been issued or the applicant elects to comply with later amendments.

In recent rulemakings, the FAA has carefully considered whether corresponding retroactive action is warranted whenever a change to the airworthiness standards

for type certification was proposed. In those cases where it has been deemed that a safety benefit commensurate with the cost could be achieved, the rulemaking has also included a proposal to change the relevant operating regulations to require newly manufactured airplanes and/or airplanes in service to comply retroactively with the new standards, regardless of whether such compliance would be required as a condition of type certification. For instance, some of the regulations implemented in recent revisions to part 25 for newly manufactured airplanes were required for the existing fleet and were implemented in the operating regulations, such as part 121.

In 1965, the FAA granted an exemption from the provisions of Sec. 21.19(b)(1) to permit conversion of a four-engine amphibian to a twin-engine configuration without the applicant applying for a new type certificate. During the 1980's three applicants petitioned for exemptions from the above regulations so they could convert Boeing 727 airplanes from the original three-engine configuration to ones with two engines without having to apply for new type certificates. Another applicant petitioned for a similar exemption to replace the four engines of a Lockheed 1329 Jetstar aircraft with two engines of more recent vintage. The FAA granted each exemption with the condition that the petitioner comply with the provisions of then current part 25 in all areas, systems, components, equipment, or appliances affected by the conversion.

The FAA also granted a number of exemptions that permitted

increasing the number of engines without the need for the applicants to obtain new type certificates. In 1985, an applicant received an exemption to replace two reciprocating engines in Grumman Albatross amphibians with four turbo propeller engines without having to obtain a new type certificate. In granting the exemption, the FAA concurred that the alteration should improve the Albatross by increasing safety, increasing power plant reliability, and improving overall aircraft efficiency. The exemption noted that compliance with Sec. 21.19(b)(1) would have required changes to some basic systems that had provided satisfactory performance for many years and had contributed to the safety record of those airplanes. Applying then-current regulations to components and systems not affected by the installation of the four engines would have been time consuming and costly, and would not necessarily have contributed any safety benefits. As with the exemptions to reduce the number of engines, this exemption was granted with the condition that the petitioner comply with the provisions of then current part 25 in all areas, systems, components, equipment, or appliances affected by the conversion.

A similar exemptions also granted in 1989 to enable an applicant to increase the number of engines from one to two in certain Bell 206 series rotorcraft. The petitioner cited the increased safety afforded by a twin-engine configuration in the event a failure occurred during hover, and also the enhanced altitude performance. As a condition of the grant of exemption, the applicant was required to show that the altered

rotorcraft complied with the standards of part 27 in effect at the date of application for the change for all areas, systems, equipment, or appliances that were changed or significantly affected by the change.

These exemptions point out an important feature that has been included in this proposed rulemaking. The number of engines is not, in itself, an appropriate criterion for requiring an application for a new type certificate as long as the type design complies with the regulations effective at the date of the application for the change in those areas changed or affected by the change.

#### **Recent FAA Actions**

Apart from safety considerations, there has also been a growing international concern that some changed products are given an unfair competitive advantage over those that are of new design and must comply with later standards.

Because of these concerns, the FAA participated in the activities of an ad hoc committee sponsored by the Aerospace Industries Association of America, known as the International Certification Procedures Task Force (ICPTF). In addition to the FAA, this task force included representatives of the European Joint Aviation Authorities, Transport Canada, Aerospace Industries Association of America, Air Transport Association of America, General Aviation Manufacturers Association, International Air Transport Association, Association Europeenne des Constructeurs de Materiel Aerospacial, Aerospace Industries Association of Canada, Air Line Pilots Association, and

Association of European Airlines.

The ICPTF was organized to develop the philosophy and the necessary regulatory text and advisory material that would provide for the implementation of later regulatory amendments applicable to aeronautical products undergoing change, products in production, and products in service. The specific tasks of the ICPTF were: (1) Develop the type certification philosophy for changes to aeronautical products, including revisions to the regulations and associated advisory material; (2) Develop the necessary guidance information on the use of "service experience" in the type certification process; and (3) Develop a method to evaluate the safety impact and cost effectiveness of revisions to the airworthiness standards.

In order to develop future proposed safety standards by using a system-type analysis, the FAA chartered a committee of safety experts, known as the Aviation Rulemaking Advisory Committee (ARAC), on February 5, 1991. This committee established the International Certification Procedures Working Group, which consists of the original ad hoc committee formerly known as the ICPTF. The task assigned to this working group was to present to ARAC various proposals pursuant to its area of expertise. ARAC then had the option to submit these recommendations to the FAA, and the FAA would decide whether or not to issue a proposal based on the ARAC recommendations.

The Working Group presented to ARAC an NPRM and associated advisory material concerning the type certification procedures for changes to

aeronautical products, newly manufactured products, and products already in service. ARAC, in turn, submitted these documents as recommendations to the FAA. The FAA recognizes the difficult task the working group undertook in the effort to address the issues in this proposed rule and in the advisory material. Much of the work done within the working group could not have been accomplished without the assistance of working group members representing the aviation community. The rulemaking proposed by the FAA in this notice reflects the ARAC recommendations in the type certification procedures for changed products with only minor changes. Similar proposed changes have been published by the Joint Aviation Authorities.

#### **FAA's Proposed Policy on Changed Products**

The FAA intends to require that applicants for changes to type certificated products show compliance with the latest amendments to the airworthiness standards that are applicable to the product being changed. Exceptions to requiring a showing of compliance with the later amendments would be provided to accommodate variations in the kinds of type certificated products, of changes to these type certificated products, and revisions of the airworthiness standards. These exceptions would permit compliance with regulations issued prior to the regulations in effect at the date of the application for the change.

This proposed rulemaking would amend the type certification procedures for changes to type certificated products to bring the certification basis for changed

products and for newly type certificated products closer together. The intent is to ensure that when an essentially new product is developed through a series of changes, regardless of the extent of each change, the final product achieves a level of safety similar to that of a comparable new product. This concept will be tempered with the knowledge that a good design does not become unsafe as soon as a new regulation has been published.

Some differences may be acceptable between the certification basis for a product undergoing a change and the current regulations that would be applicable if a new product was being type certificated. This acceptance would be based on whether there is a defined safety issue involved in the specific product.

The FAA is already encouraging applicants of certain type certificated products undergoing alterations to comply with later amendments of the airworthiness standards. By this rulemaking, the FAA proposes to require all proposed changes for all type certificated products to comply with later amendments of the airworthiness standards. The long term result of this approach will be that an amended type certificate will have a certification basis that provides a similar level of safety to that provided by the certification basis of a new type certificate for the same product.

The FAA will issue an advisory circular based on this rulemaking. This advisory circular will provide guidance on determining the certification basis for changed aeronautical products, including identifying the conditions under which it will be necessary to apply for a

new type certificate. By separate notice, in this issue of the Federal Register, the FAA is also inviting interested persons to comment on the proposed advisory circular. The FAA will consider comments from this notice and comments received on the advisory circular before taking any final action on either.

### **Discussion of the Proposed Rulemaking**

Sections 11.11, 21.19, 21.101, 21.115, and 25.2 would be amended as follows to implement the policy discussed above in relation to changes to products:

#### *Section 11.11*

Current Sec. 11.11 lists special conditions required as prescribed under Sec. 21.101(b)(2) as an FAA record that is maintained in current docket form in the Office of the Chief Counsel. To remain consistent with the proposed changes to Sec. 21.101, described later, it is necessary to amend Sec. 11.11 to refer to Sec. 21.101(c) instead of Sec. 21.101(b)(2). This would not be a substantive change.

#### *Section 21.19*

Current Sec. 21.19(a) states that any person who proposes to change a product must make a new application for a type certificate if the Administrator finds that the proposed change in design, configuration, power, power limitation (engines), speed limitations (engines), or weight is so extensive that a substantially complete investigation of compliance with the applicable regulations is required. This sentence has caused confusion because it covers several types of changes for all products--airplanes, rotorcraft, aircraft engines, and propellers. In addition, current

paragraph (b), (c), and (d) list other specific types of changes that mandate a new application for a type certificate. Only the general language of current paragraph (a) would be incorporated into the new Sec. 21.19, while the previously listed specific changes would be subject to case-specific evaluations to determine whether they are substantial. Application of Sec. 21.19 would depend upon an evaluation of whether the proposed change in "design, power, thrust, or weight" would necessitate a substantially complete investigation of the compliance of the changed product. Each of the following airplane design changes, considered alone, could typically be regarded as substantial design change:

- (1) Change from a high wing to a low wing airplane, or vice versa;
- (2) Change of empennage configuration for larger airplanes (cruciform vs 'T' or 'V' tail);
- (3) Complete repositioning of engines (tail to wing, etc.); and
- (4) An increase in airplane design complexity resulting from an increase in the number of engines.

Currently Sec. 21.19(b) describes specific changes for which the applicant must apply for a new aircraft type certificate. These include (1) changes in the number of engines or rotors; and (2) changes to engines or rotors using different principles of propulsion or to rotors using different principles of operation. Historically, these types of changes have fallen into one of two categories--those that were not extensive enough to require a new application for a type certificate, as evidenced by the

large number of exemptions that have been granted over the past quarter century, or those that were so extensive that a new application was required because a complete investigation of compliance is required.

Accordingly, the provisions of current Sec. 21.19(b) are not needed and are not included in this proposal. The exemptions that have been granted from current Sec. 21.19(b) have typically required that those areas, systems, components, equipment, and appliances that are changed or significantly affected by the change must comply with the applicable regulations in effect at the date of the application for that change. This requirement would be embodied in proposed Sec. 21.101, which would generally require that an applicant for a change to a type certificate must comply with the regulations in effect at the date of the application for that change, with an exception, however, that those areas, systems, components, equipment, and appliances not affected by the change could continue to comply with the regulations incorporated in the reference type certification basis.

Accordingly, this proposed amendment would be consistent with the exemptions that have been granted on changes in the number of engines. The need for requiring a new application for a type certificate would be alleviated in many instances by the proposed changes to Sec. 21.101.

Current Sec. 21.19(c) describes another specific change in which the applicant must apply for a new aircraft engine type certificate. This change is in the principle of operation. Also, current Sec. 21.19(d) describes specific changes in which the applicant must apply for a new

propeller type certificate. These changes are in the number of blades or principle of pitch change operation. Invariably, the type of changes set forth in both of these sections are so extensive that a new application would be required in any event because a complete investigation of compliance is required. Accordingly, this proposal would delete these types of changes from Sec. 21.19. Under proposed Sec. 21.101, with certain exceptions, these types of changes and all areas, systems, components, equipment, and appliances affected by the changes would have to comply with the regulations in effect at the date of application for the change to the type certificate.

#### *Section 21.101*

Current Sec. 21.101(a) states that if a person applies for a change in a type certificate, the product must comply with either the regulations referenced in the type certificate or the applicable regulations in effect at the date of the application for the change, if elected by the applicant, plus any other amendments the Administrator finds to be directly related.

Current paragraph (b) addresses novel or unusual design features where the Administrator finds that the regulations incorporated by reference in the type certificate do not provide adequate standards. In this case the applicant must comply with the regulations in effect at the date of the application for the change and any necessary special conditions "to provide a level of safety equal to that established by the regulations incorporated by reference in the type certificate for the product". This means that the level of safety must be at least equal to the level of safety that was

required by the regulations referenced in the type certificate.

To ensure that the products meet the latest airworthiness standards wherever practicable, proposed Sec. 21.101 would specify that, with certain exceptions, the applicant for a change must comply with the applicable regulations in effect at the date of the application for the change. The intent of this proposal is to apply the applicable regulations in effect at the date of the application to those areas, systems, components, equipment, and appliances affected by the change. For those areas, systems, components, equipment, and appliances not affected by the change, continued compliance with the regulations incorporated by reference in the type certificate is considered acceptable. Section 21.101(a)

This proposed paragraph would require an applicant for a change to a type certificate to comply with the applicable regulations in effect at the date of the application for the change, also referred to as the later regulations, and with parts 34 and 36. Section 21.101(b)

This proposed paragraph would provide exceptions to the regulation in proposed paragraph (a), permitting the applicant to comply with earlier amendments to the regulations. A "regulation" as used herein means individual paragraphs of the Federal Aviation Regulations or predecessor regulations. When choosing the amendment level of a regulation, all related regulations associated with that amendment level would have to be included. The amendment level chosen would not be allowed to predate either the existing basis or anything required by the retroactive



sections, Secs. 23.2, 25.2, 27.2, or 29.2. Design changes vary in both complexity and magnitude so it is necessary for each proposed change to be evaluated on a case by case basis, taking into account previous changes and their certification basis. Individual incremental changes may be modest; however, the cumulative effect can result in a significant overall change. In this context, the following factors should be considered: (1) the extent of the previous changes and the extent to which later amendments have been addressed for these individual changes; and (2) the extent of revisions to the airworthiness standards from those of the original certification basis of the model being changed. When an essentially new product is developed, step by step, through a series of non-substantial design changes, it should achieve a level of safety similar to that of a comparable new product.

Substantial changes are addressed in Sec. 21.19. Those that are not substantial will be either nonsignificant or significant. A small weight increase or the installation of a flight management system is an example of a non-significant change. The installation of a cargo door is an example of a significant change. A change from a low wing to a high wing is an example of a substantial change.

In evaluating a design and making the final determination of nonsignificant or significant, under the exceptions provided for in Sec. 21.101(b), the FAA would rely on documented engineering, safety, and economic data. Any data submitted by the applicant should have the same degree of thoroughness and engineering

quality expected for initial compliance with airworthiness standards. Section 21.101(b)(1)

This proposed paragraph would provide the first exception to the regulation in proposed paragraph (a), to show compliance with the later applicable regulations. The proposed paragraph would state that the applicant would be allowed to demonstrate compliance with earlier regulations, but not earlier than the regulations incorporated in the existing certification basis, if the effect of the proposed change is not significant, taking into account earlier design changes and previous updating of the type certification basis.

There may be concurrent significant and non-significant changes made to a product. For example, there may be a small change in the model of engines used at the same time large changes are made to the airframe. Each part of the total change would be evaluated to determine its significance on its own merit. It must be recognized, however, that a number of related non-significant changes may collectively represent a significant change to the product. Section 21.101(b)(2)

This proposed paragraph would provide the second exception to the regulation in proposed paragraph (a), to show compliance with the later applicable regulations. The proposed paragraph would state that the applicant may show compliance with earlier regulations for those areas, systems, components, equipment, and appliances that are not affected by the change.

The FAA recognizes that arbitrarily requiring compliance with later regulations in areas,

systems, components, equipment, and appliances not affected by the change may cause redesign of components that have an acceptable service record without an attendant improvement in safety, or may have the counterproductive effect of discouraging any changes at all, including those that would provide a notable improvement in safety. Section 21.101(b)(3)

This proposed paragraph would provide the third exception to the regulation in proposed paragraph (a) to show compliance with the later applicable regulations. If compliance with a regulation in effect at the date of the application for the change would not contribute materially to the level of safety of the product to be changed, or would be impractical, the applicant may demonstrate compliance with an earlier amendment of a regulation provided that the amended regulation does not precede either the corresponding regulation in Secs. 23.2, 25.2, 27.2, or 29.2 of this chapter, or the corresponding regulation incorporated by reference in the type certificate.

Compliance with the later amendment would be considered to "not materially contribute to the level of safety" if the level of safety achieved by the existing design with the proposed design change would not be enhanced by compliance with that later amendment. In demonstrating this, the applicant would show that the level of safety achieved by the existing design incorporating the proposed design change would achieve a safety level similar to that reflected in the later amendment.

The factors that would be considered in comparing the level of safety achieved by the

existing design incorporating the proposed design change with the level of safety achieved by compliance with the later amendment would include: whether the product has compensating design features; the extent that the service experience of the product shows that the operational performance and reliability of the product provides a level of safety similar to that of later amendments; and whether compliance with a later amendment, notably when it necessitates a redesign, would have an adverse effect on safety in terms of operational performance and reliability.

Nothing would limit the future operation or transfer of a product after a design change is approved with an older certification basis; furthermore, the intent of this proposal is to establish certification bases appropriate to the designs of the products and the designs of the changes. Therefore, if an applicant for a design change is changing one or two items of a product, and another applicant is making the same change to 100 items of the same product, the applicant's design changes should be certificated to the same basis.

Demonstrating that compliance with later regulations would not materially contribute to the level of safety could necessitate analyses of the safety features of the existing design and the proposed change, and an analysis of the safety concerns addressed by the relevant amendment. The evaluation may be accomplished using a numerical- statistical approach, subject to the availability and relevance of applicable data. In practice, engineering judgment, based on scientific, rational, and reasoned analysis of the relevant data, would be used in the

development of this evaluation. The essentials of the evaluation would involve:

- a. A clear understanding of the regulatory change and what prompted the change;
- b. A detailed knowledge of the proposed design feature; and
- c. A comprehensive review of the applicable service experience.

An applicant may be unable to show that compliance with the original certification basis, together with the level of safety demonstrated by the applicable service experience, provides a level of safety similar to that of the later airworthiness regulations. If compliance with the later airworthiness regulations would then involve a design change, the benefits of such a redesign would be considered in the light of any possible adverse effects of the redesign on safety.

An applicant for a change to a type certificate would not be required to demonstrate that the changed product complies with a later amendment to an airworthiness standard if the applicant shows that such compliance would be "impractical". Compliance with a later amendment would be considered "impractical" when the applicant can establish that the cost of the design change and related changes necessary to demonstrate compliance with the amendment would not be commensurate with the resultant safety benefit. Where compliance with the later amendment would prompt a redesign, the cost of redesigning other parts of the product to accommodate this redesign also would be considered.

The FAA continually weighs the desire for the maximum level of

safety with the cost to the manufacturers, operators, and traveling public for achieving that level of safety. If the designer of an aircraft in development is tasked with incorporating a "change" to a system in that new design, the designer usually has many more options in making "changes" to related systems to accommodate the "change". Conversely, the systems related to a system to be changed in a certificated design have been established, and there may be few such options, if any. These restraints are exacerbated by a change in the certification basis, and the consideration of the service experience of the product. Under these conditions, it may become unreasonably costly for the change to comply with the latest standards.

A safety benefit-resource evaluation could be used to assist in determining impracticality, and would be discussed between the applicant and the Administrator while establishing the certification basis. The economic issues associated with compliance with the later amended airworthiness standards would be a major portion of this evaluation.

Any safety benefit-resource evaluation used to determine "impractical" should evaluate the enhancement of the safety involved with complying with the airworthiness regulation under consideration along with the cost associated with this compliance. This evaluation would weigh the factors associated with the safety benefit and the factors associated with the cost of compliance.

The factors involved with the safety issue could include seriousness of the consequences of the hazard that the regulatory change addresses, frequency, of

those consequences, and the effectiveness of applying the regulatory change to the changed product. The factors involved with the cost of compliance could include labor, new capital equipment needed, materials, operating cost increase, and revenue loss. The agency is seeking comments on this concept of using "Impractical" as defined herein. Associated Advisory Circular

The proposed associated advisory circular includes guidance for purposes of complying with the requirements of this proposed rule. This advisory circular also contains a safety benefit-resources evaluation guide, which was recommended by the ARAC to be an acceptable means of compliance with the exceptions of proposed Sec. 21.101(b). As elsewhere in this edition of the Federal Register, the safety benefit-resource evaluation guide has been included in the draft advisory circular for purposes of information only. The safety benefit-resource guide does describe some of the kinds of issues that the applicant would address, and the FAA would consider, in determining the certification basis in accordance with this proposed rule. Section 21.101(c)

This proposed paragraph would contain the provisions of current Sec. 21.101(b)(2) concerning special conditions. For consistency with the other proposed changes to Sec. 21.101, this paragraph would state that an applicant for a change must comply with any special conditions, and amendments to those special conditions, if needed, that would provide a level of safety equal to that established by the regulations in effect at the date

of the application for the change. The interpretation of "novel or unusual design features" shall be the same as present practice under current Sec. 21.101(b)(2). The provisions of current Sec. 21.101(b)(1), concerning the use of later regulations when the regulations incorporated by reference do not provide adequate standards with respect to the proposed change, would no longer be needed and would not be incorporated into the proposed regulation. This is because proposed Sec. 21.101(a) would require the use of later regulations.

The provisions of current Sec. 21.101(c), concerning the replacement of reciprocating engines with turbopropeller engines, are not incorporated into the proposed regulation. A change of this nature would be considered a significant change, and compliance with the regulations in effect at the date of application for the change, therefore, would be required. Section 21.101(d)

This proposed paragraph would state that an application for a change to a type certificate for a transport category aircraft would be effective for 5 years, and an application for a change to a type certificate for all other products would be effective for 3 years. These proposed effectivity periods for an application are the same as those in current Sec. 21.17 (c) and (d) for an application for a type certificate. Because current Sec. 21.101 requires compliance with the regulations incorporated by reference in the type certificate and because the certification basis of the original product doesn't change, having an effectivity period for an application for a design change has not been necessary. Under

the proposed Sec. 21.101, which would require meeting the airworthiness standards in effect at the date of the application for the change, it is necessary to limit the effectivity of the application for a change, to support the intent of the proposed regulation. This proposed section would state that if an application for a design change expires, an applicant may file a new application or apply for an extension of the original application as in present Sec. 21.17 (c) and (d). Section 21.101(e)

This proposed paragraph would contain procedures that would be applicable for changes of aircraft, aircraft engines, and propellers that have been type certificated using the airworthiness standards listed in Chapter 1. Proposed paragraph (e)(1) of Sec. 21.101 would mandate that the certification basis for a change to a product certificated under the applicable regulations that preceded parts 23, 25, 27, 29, 31, 33, or 35 would be established in the same manner as a change to a product certificated under one of these parts. For example, an applicant would be required to show compliance with the latest amendment(s) under part 23 that would apply to a change to a small airplane originally certificated under Part 3 of the Civil Air Regulations (CAR 3). A change to an airplane type certificated under Special Federal Aviation Regulation No. 41 (SFAR 41), would be handled somewhat differently. The SFAR 41 requirements incorporated by reference in the type certificate of such an airplane have expired, and may no longer be used for purposes of issuing certificates; accordingly, under proposed Sec. 21.101, only the latest

amendments of the part 23 requirements of the SFAR 41 certification basis would be applicable for a change to an SFAR 41 airplane design.

Applicability of this proposed regulation would include changes to products type certificated under Secs. 21.21 and 21.29. In addition, these proposed procedures would be applicable for changes of aircraft that have been type certificated under Secs. 21.24, 21.25, 21.27, and special classes of aircraft, where a part of the certification basis contains regulations from the airworthiness standards listed in Chapter 1.

At first glance, because some of the certification basis of aircraft type certificated under Secs. 21.24, 21.25, 21.27, and special classes of aircraft do not completely consist of airworthiness standards of the Federal Aviation Regulations, aircraft type certificated under these regulations may not appear to completely benefit from the procedures of this proposed rulemaking. However, after careful consideration, the FAA has determined that the level of safety of changes to an aircraft that has been type certificated under any of these regulations, would benefit from the enhanced safety associated with the appropriate later amendments of those portions of the airworthiness standards that are a part of the certification basis. This takes into consideration that the certification basis, in some cases, may consist of airworthiness standards as well as other requirements found by the Administrator to be necessary to provide an equivalent level of safety.

For example, the certification basis for a special class aircraft

or primary category aircraft may be based, in part, on portions of those airworthiness standards contained in Chapter 1 that were found by the Administrator to be appropriate for the specific type design. Since revisions are frequently made to the airworthiness standards to upgrade the minimum level of safety required for civilian aircraft and to incorporate certification standards for modern-state-of-the-art technology, it seems logical that the level of safety of changes to special class aircraft would benefit from compliance with the later airworthiness standards. These proposed procedures would apply only to those parts of the certification basis that were obtained from the airworthiness standards listed in Chapter 1.

Joint Aviation Requirements, JAR 22, is a published regulation being used as a means of compliance by the FAA for gliders, as a special class of aircraft, but this regulation is not listed in Chapter 1; therefore, the proposed procedures would not be applicable in this case. Although these procedures are not intended to be applicable to the Joint Aviation Requirements, an applicant may comply with the procedures when the Administrator finds them acceptable for a specific application.

Surplus military aircraft, type certificated in the restricted category under Sec. 21.25(a)(2), normally are accepted on the basis of the previous military qualifications acceptance and service record in lieu of showing compliance with airworthiness standards in Chapter 1. However, a change to these aircraft for a special purpose operation usually is not supported by the military service

history and needs to comply with an airworthiness standard. Compliance with the later amended airworthiness standard for the change would not be appropriate as the aircraft did not meet an airworthiness standard initially.

Limited category aircraft are surplus military aircraft, mostly from World War II, that were type certificated under Part 9 of the Civil Air Regulations for use other than air transport. These aircraft were not intended to carry persons or property for compensation or hire, and normally were accepted on the basis of their previous military qualifications acceptance and service record. However, a change to these aircraft usually is not supported by the military service history, therefore, the change must comply with appropriate airworthiness standards. It seems logical that the level of safety of changes to aircraft that have not been type certificated to an airworthiness standard would not benefit from compliance with the later airworthiness standards.

#### *Section 21.115*

The type certificate holder may obtain approval for a change either by amending the type certificate under Sec. 21.101 or by obtaining a supplemental type certificate under Sec. 21.115. Any other modifier would have to obtain a supplemental type certificate under Sec. 21.115. There should not be a difference in the certification basis for a change to a type certificated product between these two methods of approval, amended type certificate or supplemental type certificate.

Current Sec. 21.115 incorporates the provisions of current Sec. 21.101(a) and (b) by reference,

making the provisions of the latter section equally applicable to applicants for supplemental type certificates. In view of the proposed changes to Sec.

21.101, it is necessary to amend Sec. 21.115 to refer simply to Sec. 21.101 rather than specifically to Sec. 21.101(a) and (b). This would not be a substantive change.

#### *Section 25.2*

Current Sec. 25.2(c) incorporates the provisions of current Secs. 21.101(a)(2) and (b) by reference, addressing the subsequent revisions to the special retroactive regulations. To remain consistent with the proposed changes to Sec. 21.101, it is necessary to amend Sec. 25.2(c) to refer to Sec. 21.101(a). This would not be a substantive change.

#### **Regulatory Evaluation Summary**

The following discussion of costs and benefits is provided because the proposed procedures would be explicitly incorporated into formal regulations. By administrative policy, the FAA is already urging designers to show that certain changed products comply with selected amendments that were adopted after the initial application for type certification of the base product. It is likely that such administrative decisions would continue, to some unknown degree for an unknown proportion of type certificated products, in the absence of the proposed rule.

The proposed rule would not initiate a specific certification standard or requirement per se, but instead, would formally alter the manner in which existing and future standards would be determined to be applicable. As a result, the FAA can describe, but is not able to quantify, the

costs and benefits of the proposal. A quantification of the impacts would require a forecast of potential future changes to all commuter and transport category airplane models; all rotorcraft; and all other categories of regulated aircraft, aircraft engines, and propellers. In addition, a quantified evaluation would require a review of all applicable regulations that have been adopted during the intervening period after the type certification of the product, plus engineering appraisals of the intended changes for each product, the effects of those changes on other systems and components, and the economics associated with bringing each affected system and component up to the standards of the intervening regulations. No reasonably accurate estimate of these factors can be made.

In addition to the absence of a comprehensive estimate, no examples of such cost estimates are available for this evaluation. In some instances, the FAA has urged manufacturers of changed products to comply with later regulations. In association with these actions, individual manufacturers of proposed changed products have evaluated the costs and benefits that would be incurred to meet the pertinent standards. Due to competitive economic considerations, however, such information is considered proprietary and is not available.

The attributable costs of this proposal are the incremental costs that would be incurred to meet any additional or more stringent standards, adopted after the application for type certification of the initial product, that would not be required in the absence of this proposal. Similarly, the direct

benefit of the proposal is the augmented safety that would result from meeting such standards. Although the attributable costs and benefits cannot actually be quantified, the proposed rule is premised on an analysis to verify that any actions taken pursuant to it would be cost beneficial.

As noted in the description of the proposal, compliance with later regulations would not be required for a change that is not classified as being significant, for those areas or components not affected by the change, or where compliance with later regulations would not contribute materially to the level of safety or would be "impractical". Compliance with later amendments would be considered impractical if the applicant can show that such compliance would result in costs that are not consistent with the possible safety benefits. Further guidance on the definition of what constitutes a significant change would be provided in an advisory circular.

In addition to the benefits of any individual action taken pursuant to the proposed rule, the proposal would also generate procedural benefits. The formalization of this policy by regulation would expedite decisions about the certification basis of proposed changed products and, therefore, would provide manufacturers and modifiers with earlier and more dependable information on which to base their product development decisions. In addition, the proposed procedures have been harmonized with the foreign aviation authorities of Canada and Europe and the resulting common standards would reduce the costs and delays necessary to formally determine and fulfill

dissimilar international requirements.

Although the attributable costs and benefits of the proposed rule cannot be quantified, the FAA holds that it would be cost beneficial.

*(general text removed)*

### Conclusion

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this proposed regulation is not a significant regulatory action under Executive Order 12866. In addition, the FAA certifies that this proposal, if adopted, will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. This proposal is considered nonsignificant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). An initial regulatory evaluation of the proposal, including a Regulatory Flexibility Determination and International Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under FOR FURTHER INFORMATION CONTACT.

### List of Subjects

14 CFR Part 11

Administrative practice and procedure, Reporting and recordkeeping requirements.

14 CFR Part 21

Aircraft, Aviation safety, Safety, Type certification

14 CFR Part 25

Aircraft, Aviation safety, Safety, Type certification

### Regulatory Information

The Proposed Amendments

Accordingly, the FAA proposes to amend 14 CFR parts 11, 21, and 25 as follows:

### PART 11--GENERAL RULEMAKING PROCEDURES

1. The authority citation for part 11 continues to read as follows:

**Authority:** 49 U.S.C. 106(g), 40101, 40103, 40105, 40109, 40113, 44110, 44502, 44701--44702, 44711, 46102.

2. The first sentence of Sec. 11.11 is revised to read as follows:

#### Sec. 11.11 Docket.

Official FAA records relating to rulemaking actions are maintained in current docket form in the Office of the Chief Counsel. These records include: Proposals, notices of proposed rulemaking, written material received in response to notices, petitions for rulemaking and exemptions, written material received in response to summaries of petitions for rulemaking and exemptions, petitions for rehearing or reconsideration, petitions for modification or revocation, notices denying petitions for rulemaking, notices granting or denying exemptions, summaries required to be published under Sec. 11.27, special conditions required as prescribed under Secs. 21.16 or 21.101(c), written material received in response to published special conditions, reports of proceedings conducted under Sec. 11.47, notices denying proposals, and final rules or order.

### PART 21--CERTIFICATION PROCEDURES FOR PRODUCTS AND PARTS

3. The authority citation for part 21 continues to read as follows:

**Authority:** 42 U.S.C. 7572; 49 U.S.C. 106(g), 40105, 40113, 44701-44702, 44707, 44709, 44711, 44713, 44715, 45303.

4. Section 21.19 is revised to read as follows:

#### Sec. 21.19 Changes requiring a new type certificate.

Each person who proposes to change a product must apply for a new type certificate if the Administrator finds that the proposed change in design, power, thrust, or weight is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

5. Section 21.101 is revised to read as follows:

#### Sec. 21.101 Designation of applicable regulations.

(a) Except as provided in paragraph (b) of this section, an applicant for a change to a type certificate must show that the changed product complies with:

(1) Each regulation in parts 23, 25, 27, 29, 31, 33, and 35 of this chapter that is applicable to the changed product and that is in effect at the date of the application for the change; and

(2) Parts 34 and 36 of this chapter.

(b) The applicant may show that the changed product complies with an earlier amendment of a regulation required by paragraph (a)(1) of this section, and of any other regulation the Administrator finds is directly related, provided that the amended regulation does not precede either the corresponding regulation in Secs. 23.2, 25.2,

27.2, or 29.2 of this chapter, or the corresponding regulation incorporated by reference in the type certificate:

(1) For a change the effect of which, combined with all previous relevant changes, the Administrator finds is nonsignificant;

(2) For each area, system, component, equipment, or appliance that the Administrator finds is not affected by the change; and

(3) For each area, system, component, equipment, or appliance that is affected by the change, if the Administrator also finds that compliance with a regulation described in paragraph (a)(1) of this section would not contribute materially to the level of safety of the changed product or would be impractical.

(c) If the Administrator finds that the regulations in effect at the date of the application for the change do not provide adequate standards with respect to the proposed change because of a novel or unusual design feature, the applicant must also comply with special conditions, and amendments to those special conditions, prescribed under the provisions of Sec. 21.16, to provide a level of safety equal to that established by the regulations in effect at the date of the application for the change.

(d) An application for a change to a type certificate for a transport category aircraft is effective for 5 years, and an application for a change to any other type certificate is effective for 3 years. If the change has not been approved, or it is clear that it will not be approved under the time limit established under this paragraph, the applicant may--

(1) File a new application for a change to the type certificate and comply with all the provisions of paragraph (a) of this section applicable to an original application for a change; or

(2) File for an extension of the original application and comply with the provisions of paragraph (a) of this section for an effective date of application, to be selected by the applicant, not earlier than the date that precedes the date of approval of the change by the time period established under this paragraph for the original application for the change.

(e) For purposes of this section, "each regulation that is applicable to the change" includes:

(1) Each regulation that is applicable to the change that would apply to the same change in a product type certificated prior to the codification of the applicable part(s) of this chapter, if that product were type certificated at the date of the application for the change; and

(2) Each regulation that the Administrator found to be appropriate to a product type certificated under Secs. 21.24, 21.25, or 21.27, or an aircraft type certificated under Sec. 21.17(b), where the type certificate incorporated regulations from parts 23, 25, 27, 29, 31, or 35, based on the nature of the product design and the proposed change.

6. Paragraph (a) of 21.115 is revised to read as follows:

**Sec. 21.115 Applicable requirements.**

(a) Each applicant for a supplemental type certificate must show that the altered product meets applicable requirements specified in Sec.

21.101 and, in the case of an acoustical change described in Sec. 21.93(b), show compliance with the applicable noise requirements of part 36 of this chapter and, in the case of an emissions change described in Sec. 21.93(c), show compliance with the applicable fuel venting and exhaust emissions requirements of part 34 of this chapter.

\* \* \* \* \*

**PART 25--  
AIRWORTHINESS  
STANDARDS: TRANSPORT  
CATEGORY AIRPLANES**

7. The authority citation for part 25 continues to read as follows:

**Authority:** 49 U.S.C. 106(g), 40113, 44701-44702, 44704.

8. Paragraph (c) of Sec. 25.2 is revised to read as follows:

**Sec. 25.2 Special retroactive requirements.**

\* \* \* \* \*

(c) Compliance with subsequent revisions to the sections specified in paragraph (a) or (b) of this section may be elected or may be required in accordance with Sec. 21.101(a) of this chapter.

Issued in Washington, DC, on April 22, 1997.

Ava L. Mims,

Acting Director, Aircraft  
Certification Service.

[FR Doc. 97-11205 Filed 5-1-97; 8:45 am]

BILLING CODE 4910-13-M

**Final Rule Actions:**

Final Rule. Docket No. [28903](#);  
Issued on 05/31/00.





**Appendix C**  
**Federal Register, June 7, 2000, Final Rule**

Pages 36244 through 36266, which is the final rule for the Type Certification Procedures for Changed Products, begin on the next page.



[4910-13]

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**14 CFR Parts 11, 21, and 25**

**[Docket No. 28903; Amdt. No. 11-45, 21-77, 25-99]**

**RIN 2120-AF68**

**Type Certification Procedures for Changed Products**

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final rule; request for comments.

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**SUMMARY:** This document amends the procedural regulations for the certification of changes to type certificated products. These amendments affect changes accomplished through either an amended type certificate or a supplemental type certificate. The amendments are needed to address the trend toward fewer products that are of completely new design and more products with multiple changes to previously approved designs. This final rule action will enhance safety by applying the latest airworthiness standards, to the greatest extent practicable, for the certification of significant design changes of aircraft, aircraft engines, and propellers.

**DATES:** Effective Date: June 7, 2000. Mandatory compliance dates are December 10, 2001, for transport category airplanes and restricted category airplanes that have been certified using transport category standards, and December 9, 2002, for all other category aircraft and engines and propellers. Comments on the information collection requirements and the Regulatory Evaluation section, which includes the regulatory flexibility analysis, must be submitted on or before August 7, 2000.

**ADDRESSES:** Comments for this final rule should be mailed or delivered, in triplicate, to the Federal Aviation Administration, Office of the Chief Counsel, Attn: Rules Docket (AGC-200), Docket No. 28903, Room 915G, 800 Independence Avenue, SW, Washington, DC 20591. Comments submitted must include the regulatory docket or amendment number. Comments may also be sent electronically to the following Internet address: 9-NPRM-CMTS@faa.gov. Comments may be filed or examined in Room 915G on weekdays, except Federal holidays, between 8:30 a.m. and 5:00 p.m.

**FOR FURTHER INFORMATION CONTACT:** Randall Petersen, Certification Procedures Branch (AIR-110), Aircraft Certification Service, Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, telephone (202) 267-9583.

**SUPPLEMENTARY INFORMATION:**

**Compliance Dates**

This final rule requires that major changes to transport category airplanes and restricted category airplanes that have been certified using transport category standards, be evaluated under the new rules beginning 18 months from today's date of publication in the Federal Register. Major changes to all other category aircraft and engines and propellers are required to be evaluated under the new rules beginning 30 months from today's date of publication in the Federal Register.

**Comments Invited**

In the NPRM, the FAA certified that the proposed rule would not have a significant economic impact on a substantial number of small entities. The FAA has revisited the question

of the potential impact on small entities and has determined that an analysis under the Regulatory Flexibility Act of 1980, as amended, is required. This analysis and a complete analysis of potential costs and benefits are set out in the Regulatory Evaluation Summary portion of this preamble. As stated in this final rule document, the FAA determined that there could be a significant impact on a substantial number of small entities. Additionally, the cost analysis of the regulatory evaluation has undergone a substantial revision, and comments on the entire regulatory evaluation are requested.

Since this rule is being adopted without prior notice and prior public comment on the increased information collection requirements listed in the Paperwork Reduction Act section of this document, interested persons are also invited to submit such written data, views, or arguments, as they may desire, relating to the information collection requirements.

Pending the evaluation of the public comments, the FAA has decided to proceed with due diligence. This rule differs from the NPRM and has been revised to address the concerns of the majority of small entities likely to be affected by the rule. The FAA will consider and respond to comments on the Regulatory Flexibility Analysis and the information collection requirements that are subject to review by the Office of Management and Budget (OMB) under the Paperwork Reduction Act of 1995 before the compliance dates published in this document.

The FAA will consider all comments received, and will publish in the Federal Register a summary of the disposition of those comments and, if appropriate, changes to the rule that may result from consideration of those comments.

Comments must include the regulatory docket or amendment number and must be submitted in triplicate to the address above. All comments received, as well as a report summarizing each substantive public contact with FAA personnel on this rulemaking, will be filed in the public docket and will be considered by the FAA. The docket is available for public inspection before and after the comment closing date.

Commenters who want the FAA to acknowledge receipt of their comments submitted in response to this final rule must include a preaddressed, stamped postcard with those comments on which the following statement is made: "Comments to Docket No. 28903." The postcard will be date-stamped by the FAA and mailed to the commenter.

#### **Availability of Final Rule**

An electronic copy of this final rule may be downloaded, by using a modem and suitable communications software, from: the FAA regulations section of the FedWorld electronic bulletin board service (telephone: (703) 321-3339), or the Government Printing Office's (GPO) electronic bulletin board service (telephone: (202) 512-1661)

Internet users may reach the FAA's web page at <http://www.faa.gov/avr/arm/nprm/nprm.htm>, or the GPO's web page at <http://www.access.gpo.gov/nara>, for access to recently published rulemaking documents.

Any person may obtain a copy of this final rule by submitting a request to: FAA, Office of Rulemaking, Attention: ARM-1, 800 Independence Avenue, SW, Washington, DC 20591; or by telephoning (202)267-9680. Individuals requesting a copy of this final rule should identify their request with the amendment number or docket number.

Persons interested in being placed on the mailing list for future rulemaking documents should request from the above office a copy of Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, that describes the application procedure.

**Small Business Regulatory Enforcement Fairness Act**

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996, requires the FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. Therefore, any small entity that has a question regarding this document may contact their local FAA official. Internet users can find additional information on SBREFA on the FAA's web page at <http://www.faa.gov/avr/arm/sbrefa.htm> and may send electronic inquiries to the following Internet address: 9-AWA-SBREFA@faa.gov.

**Background****Statement of the Problem**

Under the regulations in effect prior to the early 1940's, an applicant for a changed product, such as an alternate engine installation, was required to apply for a new type certificate and comply with the standards current at the time of application. This did not present an unreasonable burden on the applicant then because the airworthiness standards did not change appreciably over short periods of time. That is, the standards current at the time of an application for a change were essentially the same as those with which the original product had to comply. Since the early 1940's, however, rapid changes in technology have resulted in significant changes in the airworthiness standards over relatively short periods of time. Therefore, an applicant for an extensive change to a type certificated product, which required a new type certificate, could be faced with complying with safety standards that varied considerably from the standards for the original product. To relieve this situation, the FAA's predecessor agency required an application for a new type certificate only if the change was quite extensive.

In recent years, a trend has developed towards fewer products that involve substantial design changes that would require a new type certificate. In many cases, over a period of time, a series of changes could permissively be made to a product by amending its original type certificate such that the resultant model is substantially different from the original model. Although each changed product in such a series of changes may differ little from its immediate predecessor, the changes could collectively result in a product with considerable differences from the original product. As a result, many changed aeronautical products have not been required to demonstrate compliance with all the recent airworthiness standards. This rule is intended to clarify under what conditions more recent airworthiness amendments need to be applied to changed products.

In order to achieve this goal, the FAA published a proposed rule (Notice No. 97-7; 62 FR 24288, May 2, 1997) to amend the procedural regulations for the certification of changes to type certificated products whether the change is accomplished through an amended type certificate or through a supplemental type certificate. The FAA's purpose in including supplemental type certificates (STC) was to ensure that all significant changes to a type certificated product would follow the same procedure. A related purpose was to avoid creating a loophole that would allow a type certificate (TC) applicant to choose the STC process thereby avoid complying with later amendments.

**History of Type Certification**

Title 49 U.S.C. § 44701 authorizes the FAA Administrator to promote safety of flight of civil aircraft in air commerce by prescribing minimum standards governing the design and construction of aircraft, aircraft engines, and propellers as may be required in the interest of safety, and such minimum standards governing appliances as may be required in the interest of safety.

Under 49 U.S.C. § 44704, the FAA may issue type certificates, including supplemental type certificates, for aircraft, aircraft engines, propellers, and certain appliances.

The general certification procedures for products (aircraft, aircraft engines, and propellers) and parts are set forth in 14 CFR part 21 (part 21). As described in §§ 21.13 and 21.15, any interested person may apply for a type certificate by submitting an application accompanied by the required documentation to the FAA. Sections 21.16 through 21.21, 21.101, and 21.115 specify certain regulations and designate the applicable airworthiness standards for type certification of both new and changed products. The term "changed product" is used throughout part 21 and throughout this preamble to include changes that are made through an amended type certificate, as well as those made under a supplemental type certificate. A person who is not the type certificate holder has only the STC option while the type certificate holder has the option of applying either for an amended type certificate or for an STC.

Section 21.17 designates the applicable regulations for the issuance of type certificates. In order to be issued a type certificate, the applicant must show that the product complies with the airworthiness standards contained in one of the following 14 CFR parts, as applicable: part 23 for normal, utility, acrobatic, and commuter category airplanes; part 25 for transport category airplanes; part 27 for normal category rotorcraft; part 29 for transport category rotorcraft; part 31 for manned free balloons; part 33 for aircraft engines; part 35 for propellers; and part 21 (§ 21.17(b) and (f)) for special classes of aircraft and primary category aircraft, respectively.

The airworthiness standards in these parts of the regulations may be amended as needed to reflect continually changing technology, correct design deficiencies, and provide for safety enhancements. An applicant for a type certificate is required under current § 21.17, with certain exceptions, to show that the product meets the applicable airworthiness standards that are in effect on the date of the application. The exceptions include instances in which the Administrator specifies otherwise, or in which the applicant either elects or is required under specific circumstances to comply with later effective amendments. In addition, the Administrator may prescribe special conditions.

Under § 21.16, special conditions may be prescribed if the Administrator finds that the existing airworthiness standards do not contain adequate or appropriate safety standards because of novel or unusual design features of the product to be type certificated relative to the design features considered in the applicable airworthiness standards. Also, under § 21.21(b)(1), if any applicable airworthiness standards are not complied with, an applicant may nevertheless be entitled to a type certificate if the Administrator finds that those standards not complied with are compensated for by factors that provide an equivalent level of safety. Such determinations are commonly referred to as "equivalent safety findings" and are made with respect to the level of safety intended by the applicable standard. In addition, under § 21.21(b)(2), an applicant may be denied a type certificate if the Administrator finds an unsafe feature or characteristic of the aircraft for the category in which type certification is requested, even though the aircraft may comply fully with the applicable airworthiness standards.

Taken together §§ 21.16, 21.17, and 21.21 designate the applicable airworthiness regulations for type certification and accommodate those circumstances when the airworthiness standards do not adequately cover the design features of a product. These sections recognize and balance the following four important considerations:

(1) The FAA is obligated, under 49 U.S.C. § 44701, to keep the airworthiness standards required in the interest of safety, (i.e., parts 23, 25, 27, 29, 31, 33 and 35) as current as practicable.

(2) The type certificate applicant needs to know, early in a certification program, what the applicable airworthiness standards will be in order to finalize the detailed design of its product and to enable the applicant to make reasonable performance guarantees to its potential customers.

(3) In the interest of safety, rapid technological advances presently being made by the civil aircraft industry necessitate that the FAA be able to issue special conditions to address novel or unusual design features that it has not yet had an opportunity to address in the airworthiness standards through the general rulemaking process, or to address novel or unusual design features that were not considered by the appropriate airworthiness standards applicable to changes to type certificates.

(4) It is also important to allow flexibility in design. Wherever possible, the airworthiness standards of 14 CFR Chapter 1, subchapter C, are intentionally written as performance standards, and the procedural regulations permit design changes over the operational life of a product.

### **History of Type Certification of Changes**

Part 21 designates the applicable airworthiness standards for changed products. Section 21.19 describes the circumstances in which an applicant for type certification of a changed product must apply for a new type certificate. As previously discussed, before the early 1940's, an applicant for a changed product, such as an airplane with an alternative engine installation, was required to apply for a new type certificate. For the reasons already described, by the early 1940's, an application for a new type certificate was required only if the change was quite extensive.

Under § 21.101, the original type certificate may be amended to include changes to the product when the applicant demonstrates that it complies with the same airworthiness standards as the original product plus appropriate special conditions, and the change does not warrant making a new application for a type certificate under § 21.19. Because § 21.101(a) and (b) are incorporated by reference in § 21.115, these procedures are equally applicable to persons applying for supplemental type certificates.

Section 21.101(a) requires that an applicant for a change to a type certificate must comply with either the regulations incorporated by reference in the type certificate or the applicable regulations in effect on the date of application, plus any other amendments the Administrator finds to be directly related. The "regulations incorporated by reference" are the regulations that were the certification basis for the original issuance of the type certificate or any later regulations that were the certification basis for any changes to the original type certificate.

If an applicant chooses to show compliance with the regulations in effect on the date of the application for the change, the applicant must also comply with any other amendments that are directly related. In some instances, a regulation may have been amended to become less stringent, while a related regulation has become more stringent. In this situation, an applicant must also comply with the related more stringent regulation. Current § 21.101(a) does not otherwise require compliance with later amendments and does not grant the Administrator the authority to require compliance with later regulations as a method to increase the level of safety of a product.

An applicant for a change to a type certificated product is responsible for showing that the product, as altered, not just the change itself, complies with the existing certification basis, because areas that have not been changed may be affected by the change. However, the applicant

need not resubstantiate those areas of the product where the original substantiation has not been invalidated by the change.

Current § 21.101(b) pertains to changes for which the regulations incorporated by reference do not provide adequate standards. Such changes generally involve features that were not envisaged at the time the regulations incorporated by reference were adopted and are, therefore, novel or unusual with respect to those regulations. For these changes, the applicant must comply with regulations in effect on the date of application for the change as found necessary to provide a level of safety equal to that established by the regulations incorporated by reference. In this case, the applicant is not able to select any amendment of the regulation it chooses between those incorporated by reference and those in existence on the date of the application. When regulations in effect on the date of application for the change fail to provide adequate standards, the applicant must comply with special conditions to provide a level of safety equal to that established by the regulations incorporated by reference.

### **Trends in Type Certification of Changes**

In recent years, a trend has developed toward fewer products that are of completely new designs, which would require new type certificates. Over a period of time, a series of changes to an original product may have been made so that the current model is considerably different from the original model. Although each changed product in such a series of changes may differ little from its immediate predecessor, the changes could result collectively in a product with substantial differences from the original product.

Another trend in manufacturing is to keep products in production over several decades. Some currently manufactured airplanes have, for example, evolved from airplane models originally type-certificated 25 years ago. This does not imply that those airplanes are "unsafe," because they do, in practice, have features that address the intent of most of the current airworthiness standards. However, current procedural regulations (part 21) do not require that changed products demonstrate compliance with all the current airworthiness standards.

The basic premise behind the FAA's current policies for the procedures and airworthiness standards for type certification is that the highest possible degree of safety in the public interest should be achieved by products being certificated at any given time. In dealing with this premise, the FAA has had to continually weigh the desire for the highest level of safety with the cost to the manufacturers, operators, and traveling public for achieving the highest possible degree of safety in the public interest. This balance between safety and cost has been exacerbated by the introduction of highly sophisticated products whose development and manufacture have become enormously expensive. As already stated, this is one reason manufacturers choose to produce more and more changed products that, by the FAA regulations, are not required to have new type certificates.

The FAA maintains that the issue should not be whether a product is produced under a new type certificate or a changed one. The issue is whether or not the level of safety of the product, embodied in the airworthiness standards it complies with, is as high as practicable. In addition, to require areas unaffected by the change to comply with the later standards could not only be unreasonably costly but could reduce the level of safety of the product due to unforeseen developmental problems. The manufacturers are constantly issuing service information that describes approved alterations that users may make to improve the level of safety of the product.

When establishing the highest practicable level of safety for a changed product, the FAA has determined that it is appropriate to assess the service history of a product, as well as the later airworthiness standards. It makes little sense to mandate changes to well understood designs, whose service experience has been acceptable, merely to comply with new standards. The clear



exception to this premise is if the new standards were issued to address a deficiency in the design in question, or if the service experience is not applicable to the new standards. This consideration of airworthiness standards and service experience should form the basis for developing the certification basis for a change in a product.

While it can be argued that, for consistency, new airworthiness standards should apply across-the-board to the entire aircraft fleet, application of new standards would not be practical in every case. Although newly designed aircraft are required to meet all applicable current airworthiness standards, in many cases a product being changed, for which only an amended type certificate is needed, is required to meet only the standards referenced in the original type certificate or in an amended type certificate. Thus, there may be a considerable difference between the standards required for a new product and for a product undergoing change. A product undergoing change that met the applicable standards at the time of original or amended type certification is not currently required to meet more current airworthiness standards, except in those instances where retroactive regulations have been issued or the applicant elects to comply with later amendments.

In recent rulemakings, the FAA has carefully considered whether corresponding retroactive action is warranted whenever a change to the airworthiness standards for type certification was proposed. In those cases where it has been determined that an across-the-board safety benefit commensurate with the cost could be achieved, the rulemaking has also included a proposal to change the relevant operating regulations to require newly manufactured airplanes or airplanes in service, or both, to comply with the new standards, regardless of whether such compliance would be required as a condition of type certification. For instance, some of the regulations implemented in recent revisions to part 25 for newly designed airplanes were required for the existing fleet and were implemented in the operating regulations, such as part 121.

### **Recent FAA Actions**

In addition to the safety considerations previously described, there has also been a growing international concern that some changed products are given an unfair competitive advantage over those that are of new design and must comply with later standards.

Because of these concerns, beginning in 1989 the FAA participated in an ad hoc committee sponsored by the Aerospace Industries Association of America, known as the International Certification Procedures Task Force (ICPTF). In addition to the FAA, this task force included representatives of the European Joint Aviation Authorities, Transport Canada Civil Aviation Authority (TCCAA), Aerospace Industries Association of America, Air Transport Association of America, General Aviation Manufacturers Association, International Air Transport Association, The European Association of Aerospace Industries (AECMA), Aerospace Industries Association of Canada, Air Line Pilots Association, and Association of European Airlines.

The ICPTF was organized to develop the philosophy and the necessary regulatory text and advisory material that would provide for the implementation of later regulatory amendments applicable to aeronautical products undergoing change, products in production, and products in service. The specific tasks of the ICPTF were: (1) develop the type certification philosophy for changes to aeronautical products, including revisions to the regulations and associated advisory material; (2) develop the necessary guidance information on the use of "service experience" in the type certification process; and (3) develop a method to evaluate the safety impact and cost effectiveness of revisions to the airworthiness standards.

In order to develop future proposed safety standards by using a system-type analysis, the FAA chartered a committee of safety experts, known as the Aviation Rulemaking Advisory

Committee (ARAC), on February 5, 1991. This committee established the International Certification Procedures Working Group, which consisted of the original ad hoc committee formerly known as the ICPTF. The task assigned to this working group was to present to ARAC various proposals pursuant to its area of expertise. ARAC then had the option to submit these recommendations to the FAA, and the FAA would decide whether or not to issue a proposal based on the ARAC recommendations.

The working group presented to ARAC a recommended NPRM and associated advisory material concerning the type certification procedures for changes to aeronautical products, changed products, and products already in service. ARAC, in turn, submitted these documents, dated October 14, 1994, as recommendations to the FAA.

The rulemaking proposed by the FAA in Notice No. 97-7 reflects the ARAC recommendations in the type certification procedures for changed products with mostly minor changes in the preamble to the proposed rule. The Joint Aviation Authorities (JAA) have published similar proposed changes. That document was circulated for public comment on June 10, 1996, in NPA 21-7.

At the same time the FAA issued Notice No. 97-7, the FAA announced the availability of a proposed companion advisory circular (AC) for public comment. While the FAA's proposed AC was based on a draft submitted by the ARAC, the FAA's version was significantly reorganized and rewritten except for the proposed appendices which were identical to those recommended by the ARAC. Also, the FAA stated in Notice No. 97-7 that while the ARAC recommended that the safety benefit resource evaluation guide included in the proposed AC (Appendix 2) be considered an acceptable means of showing compliance with the exceptions of proposed § 21.101(b), the FAA included this guide for information purposes only. The FAA stated, "The safety benefit resource guide does describe some of the kinds of issues that the applicant would address, and the FAA would consider, in determining the certification basis in accordance with the proposed rule."

After the comment period on Notice No. 97-7 closed, the FAA tasked the ARAC to review the public comments and to recommend to the FAA a disposition of the comments and a draft final rule document. This final rule reflects most of the work of the ARAC under this task. This work was accomplished largely through a series of ARAC working group meetings held between August of 1997 and July of 1998. Because of an FAA imposed deadline date of September 1, 1998, the working group members submitted their comments to the ARAC based on a draft final rule dated August 4, 1998. The August 4, 1998, draft was based on the working group's previous recommended disposition of comments and on discussions and agreements reached at the final working group meeting held on July 7-8, 1998. The ARAC, at FAA's request, forwarded a report that included this draft and the comments to the FAA at the August 24, 1998, issues meeting. At the time of the report, consensus had not been reached on the draft final rule. Because many of the comments received from working group members and from the full ARAC members before and at the August 24 meeting duplicated comments that were made on the NPRM, the FAA has not attempted to deal separately and repetitively in this preamble with these post-comment period ARAC comments.

### **FAA Rulemaking on Changed Products**

This rulemaking amends the type certification procedures for changes to type certificated products to bring the certification basis for significantly changed products (whether the change is by amended type certificate, supplemental type certificate, or amended supplemental type certificate) closer to the current regulations. The intent is to ensure that when an essentially new

product is developed through a series of changes, the final product achieves a level of safety similar to that of a comparable new product.

By this rulemaking, the FAA requires all proposed changes for all type-certificated products to comply with the latest amendments of the airworthiness standards, unless one of the stated exceptions applies. The long term result of this rule change will be that a changed product will have a certification basis that provides a similar level of safety to that provided by the certification basis of a new type certificate for the same product, except as provided in the rule.

As discussed more fully later in this preamble, the final rule contains an approach that was not discussed in the NPRM. This approach should help minimize the procedural burden for applicants for amended type certificates and STC's for aircraft (other than a rotorcraft) with a maximum weight of 6,000 pounds or less and for non-turbine rotorcraft with a maximum weight of 3,000 pounds or less.

As stated, the FAA will issue an advisory circular based on this rulemaking. This advisory circular will provide guidance on determining the certification basis for changed aeronautical products, including identifying the conditions under which it will be necessary to apply for a new type certificate. For the reasons discussed below, this final advisory circular will follow the draft AC originally proposed by the ARAC, with changes as necessary to conform to the final rule language and to international harmonization.

#### **Discussion of Comments Received on the NPRM**

The FAA received over 90 comments on the NPRM. Commenters included aircraft manufacturers and operators, organizations representing these groups, foreign entities, and individuals.

More than half of the comments focus on the issue of applicability of the proposed rule changes to supplemental type certificates (STC's) and type certification amendments for small part 23 airplanes, particularly older airplanes. Virtually all of these commenters state that the proposed rule and advisory circular were designed for transport category aircraft by persons involved in manufacturing or using transport category aircraft. These commenters urge that non-transport category aircraft not be included in the final rule. Several request an extension of, or reopening of, the comment period, stating that the in-service modifier community was not involved in the development of the NPRM and asserting that much of this community was not even aware of the NPRM until after the comment period closed. (For further detail, see discussion of comments under the heading "Applicability to General Aviation Aircraft and to Supplemental Type Certificates.")

Many of the commenters request that the preamble and advisory circular be rewritten to reflect more closely the recommendations by the Aviation Rulemaking Advisory Committee (ARAC). Many of these commenters state that one of the main purposes of this NPRM was to achieve harmonization with the Joint Aviation Authorities (JAA) and that to the extent the FAA departed from the ARAC recommendation, harmonization was lost because the JAA Notice of Proposed Amendment (NPA) was very closely aligned with the ARAC recommended document. (For further detail, see discussion of comments under "ARAC Recommendation and Harmonization" and "Rewrite of AC from ARAC Draft.") Comments that suggest specific substantive changes to the proposed rule language are summarized and addressed under the section-by-section portion of this preamble.

Many commenters made specific comments on the proposed advisory circular. These comments are not discussed in this document but are being considered by the FAA.

In view of the harmonization goal of this rulemaking and the intended close relationship between the FAA's Notice No. 97-7 and the JAA's NPA 21-7, the FAA included the comments received by the JAA in the FAA public docket and the ARAC reviewed the relevant comments on NPA 21-7. Except for the issue of applicability to aircraft modifiers, the comments on NPA 21-7 were mostly from the same entities that commented on this rulemaking and these comments did not differ significantly from the comments on FAA's Notice No. 97-7. Therefore, this document does not separately address the comments received on NPA 21-7.

#### General and Miscellaneous Comments

Comments: One commenter, in reference to the preamble section "Recent FAA Actions," says that the FAA's mandate, under 49 U.S.C. § 44701, is to promote safety and safety regulations. This commenter says that the FAA has no mandate or legal basis for "making regulations designed to manipulate competitive forces or marketplace decisions."

Fairchild Aircraft Inc. (Dornier) also states its concern that the real problem being addressed by the FAA is not a safety problem, but rather the potential for an unfair trade advantage.

Hiller Aircraft expresses opposition to the proposal and states that current §§ 21.16, 21.19, and 39.1 already provide the FAA with "the regulatory flexibility to prescribe applicable rules for any newly proposed design, any design being considered for change and any design found to be unsafe through field experience." Hiller says that the proposal would be administratively burdensome on the FAA and manufacturers, while not providing the FAA with any additional regulatory power. Fairchild also concludes that the proposed rule would only create more bureaucratic paperwork, and increase the cost of the certificated product without compensating increases in safety.

FAA Response: While international concern over potential unfair competitive advantages that could result if different standards are applied to similar changed products, was cited as one of the triggering events for this rulemaking, that concern was not the basis for justifying the changes proposed in Notice No. 97-7. As the NPRM preamble described at some length, and as summarized in the Background section of this preamble, the FAA's justification for the proposed change was a safety justification, namely, to ensure that significantly changed products comply with later requirements that apply to new products to the maximum extent practicable.

With respect to the possible increased administrative burden on the FAA, this rule will, to some extent, decrease the FAA's administrative burden. Under the present rule, the FAA must demonstrate that the regulations incorporated by reference in the type certificate are not adequate to achieve the established level of safety when an applicant applies for a change to a type certificate. Under the proposed and final rule language, except for certain specified smaller aircraft, the initial burden will be on the applicant to show that it should not be required to comply with the regulations in effect on the date of the application because it meets one of the stated exceptions. As stated in the NPRM, compliance with the regulations in effect on the date of application where required by this rule will enhance the level of safety for the changed product. The burdens on the applicants are unavoidable if the objectives of the rule are to be achieved. Advisory Circular 21.101-XX that will be issued prior to the mandatory compliance dates of this rule will contain guidance intended to reduce the administrative burden on both the applicant and the FAA.

#### Retroactive and Retrofit Requirements

Comments: The European Association of Aerospace Industries (AECMA) states that the "key point in ensuring steps forward in safety is to clearly define the applicability of the new

standards at the time of the rule elaboration." Applicability to changed, newly manufactured or in-service aircraft may be mandated through appropriate amendments to CFR §§ 23.2, 25.2, 27.2 and 29.2 (special retroactive requirements), or to the operational regulations (for instance part 121, subpart J).

AECMA also states that the methodology used to assess possible retroactive applicability of new standards should follow the principles of AC 21.101-XX, Appendix 2, with the necessary adjustments for each category of product. In addition, the harmonization process should be extended to the retroactive requirements. While promoting the implementation of the real safety improvements, this approach would allow the manufacturers to clearly anticipate the requirements applicable to their products, instead of entering into case by case non-public discussions with possible unequal treatment.

FAA Response: Whenever the FAA adopts a new design requirement, it determines whether to apply that requirement to previously type certificated, but changed products, through a retroactive design requirement, or to previously manufactured aircraft through an operating rule. However, that determination is not the same as the determination that must be made when the FAA receives an application for a changed product. The determination of which amendments should be applied depends on the safety benefits to be realized from the proposed change, and the design, operational, and other cost burdens. Therefore, the FAA does not agree that the generalized normal retroactive and retrofit determinations are sufficient for dealing with specific changed products.

#### Consistency of Application within FAA

Comments: Raytheon suggests that in conjunction with the implementation of this rule the FAA should consider an Aircraft Certification Office (ACO) oversight program that would include (1) annual review of ACO's and new changes to type certificated products; (2) quarterly report submittal from ACO's stating amendment level of rules mandated for incremental changes; and (3) feedback from the FAA Directorate if it sees a consistent pattern from one ACO where the later rule amendments are not being imposed. Raytheon's recommendations are intended to ensure more equitable compliance requirements to avoid giving some region or manufacturer an economic advantage. Raytheon also recommends that the FAA implement an appeal process for an applicant who strongly disagrees with an ACO decision.

FAA Response: One of the tasks assigned to the ARAC was to assist the FAA in developing follow-up training for both government and industry to facilitate implementation of this final rule. It is the FAA's intent that all FAA employees called on to implement this final rule will receive appropriate training and implementation documents, such as internal orders and handbooks. The FAA will also implement other appropriate follow-up actions to ensure that the rule is being implemented uniformly throughout the FAA.

The ability of an applicant to appeal an ACO certification decision would not be changed by this rule. If not sooner resolved by the FAA appeals process (through the accountable Directorate), such a decision would be, ultimately, adjudicated as part of a certificate denial. A certificate denial is a "final order of the Administrator," appealable to a U.S. Court of Appeals pursuant to 49 U.S.C. § 46110.

#### Potential for Adverse Safety Effect

Comments: One commenter predicts that the likely effect of enacting the proposed rule will be that no changes to existing aircraft designs will be incorporated due to the increased cost of certification. As a result, no safety improvements would occur.

Representatives of the in-service modifier community make the same point with respect to safety improvements that would require an STC. (See discussion under "Applicability to General Aviation Aircraft and to Supplemental Type Certificates").

FAA Response: The FAA does not agree that this rule will be a disincentive. The FAA recognizes the impact on airlines and independent modification companies of the requirement to have the data in order to determine significance. However, the FAA needs, in the interest of safety, to ensure that all significant changes move to the latest certification basis for affected areas when the change would contribute materially to the level basis of safety of the changed product and would be practical.

#### ARAC Recommendation and Harmonization

Comments: The most common issue discussed by the commenters (who were not focused on the in-service modifier/STC issue) related to the differences between the FAA NPRM and accompanying draft AC and the ARAC documents, and the resulting lack of harmonization with the JAA NPA which the commenters state is closer to the ARAC recommendation.

The United Kingdom's Civil Aviation Authority (CAA) states that in the NPRM the FAA policy appears to be moving towards accepting previously certificated products with a greater level of change before requiring certification as a new product. CAA comments support the need to positively limit the extent to which manufacturers should be allowed to change products without being required to certificate a product to the latest airworthiness standards. CAA suggests that the harmonization of FAA and JAA requirements remains incomplete until it is clearly understood by both FAA and JAA the extent to which the criteria for a changed product is to be applied in a particular instance.

The General Aviation Manufacturers Association (GAMA) submitted the complete ARAC recommendation dated October 14, 1994, with its comment and requests that the FAA reconsider the original ARAC recommendation in developing the final rule. Other commenters that state their concern that the FAA's NPRM and draft advisory circular were significantly different from the original ARAC recommendation (and therefore different from JAA's NPA 21-7) are the European Association of Aerospace Industries (AECMA), Pratt and Whitney Canada, Bombardier, and the Aerospace Industries Association.

FAA Response: A number of the commenters suggest rewording of the NPRM preamble to make it consistent with the document submitted by the ARAC to the FAA. The FAA has considered the substance of these comments and where appropriate, they are addressed in this final rule preamble. In general, the differences between Notice No. 97-7 and the document submitted to the FAA by the ARAC involved additional preamble language included by the FAA to clarify the intent of the proposed changes. With one exception the proposed rule language in Notice No. 97-7 was identical to the rule language recommended by the ARAC. The draft AC, which is a non-binding tool to aid compliance, is discussed later in this preamble.

#### Applicability to General Aviation Aircraft and to Supplemental Type Certificates

Comments: Over half of the comments received focus exclusively on the question of the applicability of the proposed changes to aircraft that are not certificated under part 25 (i.e., to non-transport category aircraft, frequently referred to by commenters as "general aviation aircraft") and the applicability to supplemental type certificates in general. Most of these commenters state that part 23 aircraft should be entirely excluded from this rulemaking. The specific substantive statements are summarized below.

The thrust of the comments from the general aviation and in-service modifier communities received in the public docket fell into one or more of the following categories:

1. The in-service modifier community was not aware until late in the comment period that the ARAC recommendation and the resulting FAA Notice No. 97-7 would affect it at all. Several request an extension of the comment period.

2. The basis for Notice No. 97-7 was developed and recommended by an ARAC working group composed entirely of representatives of manufacturers of transport category aircraft and their counterparts in the represented civil aviation authorities. The in-service modifier community believed that the ICPTF/ARAC working group was focused on a problem involving the manufacture of transport category aircraft, not the alteration of general aviation aircraft. The in-service modifier community argues that the older the aircraft, the more the burden would increase on STC applicants and the less relevant would be the problems and examples used to justify the rule change.

3. Notice No. 97-7 gave no indication that it would affect applicants for supplemental type certificates and none of the stated justification warranted changing the rules for STC's.

4. Nowhere in Notice No. 97-7 is there any statement to indicate a problem with STC's. The entire discussion of the problem, the regulatory history, and recent FAA actions used aircraft manufacturing examples and mostly examples involving transport category airplanes.

5. Little or no consideration was given to the potential impact of the proposed rule and associated advisory material on general aviation aircraft production or on the STC process. For example, the finding under the Regulatory Flexibility Act that the proposed amendments would not have a significant economic impact on a substantial number of small entities ignores the potential impact on persons seeking STC's for general aviation aircraft.

6. Substantively, and therefore of most significance, the proposed change would shift the burden from the FAA to the applicant to prove whether a proposed change should comply with type design amendments that have occurred after the original type certificate was issued. The in-service modifier comments and representatives state that this change in burden from a "bottom up" approach to a "top down" approach would add significant costs to numerous small businesses which apply for the majority of current STC's. The in-service modifiers also dispute the relevance of FAA Order 8110.4 that established a top-down approach as a matter of policy in 1990. The in-service modifiers state that this order cannot be used to justify the rule changes proposed in Notice No. 97-7 because it was not enforceable since the rule was not changed and further because the FAA has not previously sought to apply this policy to STC's. For these reasons, this community was not even aware of its existence.

Specific written comments on the STC issue can be summarized as follows:

GAMA, EAA, NATA, and AOPA state that the proposal would be burdensome for older general aviation airplanes that would have to undergo significant and costly changes each time the in-service product is upgraded under STC procedures. GAMA adds that the re-entry into production of airplanes with older type certificates would be prevented because "product changes dictated by the FAA would be so extensive that changed products would not be cost effective due to the expense of such changes." EAA states that the change "will block safety improvements in general aviation aircraft by creating such a difficult barrier to approving Supplemental Type Certificates (STC's) that few improvements will be attempted on older aircraft designs." These commenters believe that the rule could have exactly the opposite of the intended effect by discouraging general aviation aircraft owners from improving their aircraft.

GAMA and AOPA state that, if present type certificate holders were prevented from resuming production due to economic reasons, the result would be a lack of spare parts and

technical assistance needed by current airplane owners for the continued airworthiness of their airplanes.

GAMA says that the proposal would, in effect, "render the type certificates for older out-of-production airplanes valueless due to the extensiveness of mandated FAA product changes...." AOPA states that the "proposed changes would have a tremendous negative impact on the fledgling revitalization of the general aviation industry in this country by rendering nearly all existing out of production type certificates virtually valueless."

NATA states that the NPRM fails to specifically limit the application of the rule and expresses concern that the rule requirements could be applied to unintended areas such as maintenance.

FAA Response: The ARAC recommended an exception from the most burdensome impact of this rulemaking for a significant segment of aircraft that are mostly used in general aviation operations. The FAA has adopted, in this final rule, a process that will apply to changes to these aircraft. Therefore, as is more fully discussed and explained in the section by section discussion of § 21.101, changes to aircraft (other than rotorcraft) with a maximum weight of 6,000 pounds or less and non-turbine powered rotorcraft with a maximum weight of 3,000 pounds or less, will be evaluated starting with the latest certification basis for changes to a type certificate (whether through an amendment or an STC). This exception should address the concerns of most of the in-service modifiers listed above. Reduction of the potential costs from this change are discussed in the Regulatory Evaluation Summary portion of this preamble.

While it is unfortunate that the in-service modifier community may not have recognized the potential impact on it of this rulemaking, the in-service modifier community had full opportunity to participate in the ARAC process from the date that the FAA tasked the ARAC. The fact that in-service modifier interests may not have been fully represented in the ARAC working group is not because in-service modifiers were excluded but because they elected not to participate until after the NPRM was issued.

The working group distributed its draft NPRM and AC to all ARAC members on August 30, 1994, for review and consideration. The ARAC met on October 13 and unanimously passed the proposals as written, with no substantive comments or changes. Among the organizations present at the October 13 meeting were several in-service modifier community representatives, such as, Aviation Repair Station Association (ARSA), National Air Transportation Association (NATA), Experimental Aircraft Association (EAA), General Aviation Manufacturers Association (GAMA), and the Airline Suppliers Association (ASA).

Furthermore, while the FAA decided not to extend or reopen the comment period, as previously noted, representatives of the ARAC working group and the FAA met with representatives of in-service modifiers on several occasions during the ARAC working group meetings to dispose of the comments to the NPRM. Additionally, representatives from the General Aviation community met with the Associate and the Deputy Associate Administrators for Regulation and Certification to express their concern with the conduct of the working group meetings. Their concerns were addressed and a record of these meetings are reflected in the docket.

The STC issue and potential applicability to non-transport category airplanes were addressed in Notice No. 97-7. Section 21.1(a) of part 21 prescribes procedural requirements "for the issue of type certificates and changes to those certificates; the issue of production certificates; the issue of airworthiness certificates; and the issue of export airworthiness approvals." (Emphasis added.) Supplemental type certificates are not mentioned in § 21.1 or throughout part 21 because the word "changes" is clearly used to cover all possible changes to a type



certificated product whether made by the type certificate holder, the aircraft owner, or a third party. Section 21.19 states that certain changes will require a new type certificate. Subpart D of part 21 prescribes "procedural requirements for the approval of changes to type certificates." Subpart E covers supplemental type certificates, which § 21.113 states must be applied for by any person "who alters a product by introducing a major change in type design, not great enough to require a new application for a type certificate under § 21.19...except that the holder of a type certificate for the product may apply for amendment of the original type certificate." Section 21.115, which Notice No. 97-7 proposed to amend, states that an applicant for an STC must "show that the altered product meets applicable airworthiness requirements" of § 21.101, that is, the same requirements that would apply to the holder of the type certificate. Thus, persons familiar with part 21, as are the representatives of the major in-service modifiers that commented on Notice No. 97-7, know that each proposed rule that affects "changes" under part 21 has potential broad application.

Notice No. 97-7 contained numerous statements that made it clear that the proposed amendments to existing regulations would affect persons other than transport category type certificate holders. For example:

1. Section 21.115, which applies to all applicants for an STC, is referenced early in the "History of Type Certification" section of the preamble.

2. In the "History of Type Certification of Changes" section of the preamble the following sentence appears:

Because § 21.101(a) and (b) are incorporated by reference in § 21.115 these procedures are equally applicable to persons applying for supplemental type certificates.

3. In the "Recent FAA Actions" portion of the preamble the following sentences appear:

The ICPTF was organized to develop the philosophy and the necessary regulatory text and advisory material that would provide for the implementation of later regulatory amendments applicable to aeronautical products undergoing change, products in production, and products in service. (Emphasis added.)

The working group presented to ARAC an NPRM and associated advisory material concerning the type certification procedures for changes to aeronautical products, changed products, and products already in service. (Emphasis added.)

4. In the section by section discussion of § 21.115 the following sentence appeared:

There should not be a difference in the certification basis for a change to a type-certificated product between these two methods of approval, amended type certificate, or supplemental type certificate.

5. In the Regulatory Evaluation Summary the following sentence appears:

The formalization of this policy by regulation would expedite decisions about the certification basis of proposed changed products and, therefore, would provide manufacturers and modifiers with earlier and more dependable information on which to base their product development decisions.

In view of the opportunity provided by the ARAC process before and after issuance of Notice No. 97-7 and the number of references to STC's and modifiers throughout the NPRM preamble, the in-service modifier community had adequate notice of the potential impact of Notice No. 97-7 and adequate opportunity to participate. In the Regulatory Evaluation Summary portion of this preamble the FAA has revisited the question of the potential impact on small entities and has determined that an analysis under The Regulatory Flexibility Act of 1980, as amended, is required. This analysis and a complete analysis of potential costs and benefits are set out in the Regulatory Evaluation Summary portion of this preamble.

#### Transport Category Aircraft STC's

**Comments:** ATA says that the proposal's requirement for an applicant to prove that a proposed change to be accomplished under an STC does not invoke a new safety standard will consume time and resources without improving airworthiness. ATA says that the current STC process is effective in ensuring that changes to an aircraft design are airworthy and recommends that the FAA exclude STC's from the proposed rule.

**FAA Response:** As discussed in the preamble to the NPRM Notice No. 97-7, the FAA has determined that an application for a design change through the STC process should be certificated to the same level of safety as an application for the same change through an amended type certificate. The FAA's intent is to establish an airworthiness certification basis that is not dependent on whether the applicant is applying for an amended or a supplemental type certificate.

### **Section by Section Discussion**

#### Section 11.11

Current § 11.11 lists special conditions required as prescribed under § 21.101(b)(2) as an FAA record that is maintained in current docket form in the Office of the Chief Counsel. To remain consistent with the changes to § 21.101, described later, the NPRM proposed to amend § 11.11 to refer to § 21.101(c) (now § 21.101(d)) instead of § 21.101(b)(2). The NPRM also proposed revisions to make the section read easier.

There were no substantive comments on this section and it is adopted as proposed with the cross-reference change described above.

#### Section 21.19

Current § 21.19(a) states that any person who proposes to change a product must make a new application for a type certificate if the Administrator finds that the proposed change in design, configuration, power, power limitations (engines), speed limitations (engines), or weight is so extensive that a substantially complete investigation of compliance with the applicable regulations is required. In addition, current paragraphs (b), (c), and (d) list other specific types of changes that mandate a new application for a type certificate. Notice No. 97-7 proposed to include only the general language of current paragraph (a) into the new § 21.19, while the previously listed specific changes would be subject to case-specific evaluations to determine whether they are substantial.

Current § 21.19(b) describes specific changes for which the applicant must apply for a new aircraft type certificate. These include (1) changes in the number of engines or rotors; and (2) changes to engines or rotors using different principles of propulsion, or to rotors using different principles of operation. Historically, these types of changes have fallen into one of two categories--those that were not extensive enough to require a new application for a type certificate, as evidenced by the large number of exemptions that have been granted over the past quarter century, or those that were so extensive that a new application was required because a

complete investigation of compliance was required. Accordingly, as was discussed in the NPRM preamble, the provisions of current § 21.19(b) are not needed and were not included in the proposal.

Recently, the FAA considered a petition for exemption from 14 CFR § 21.19(b)(2), to replace turbopropeller engines with turbofan engines on a transport category airplane. The petitioner argued that the certification basis for the changed airplane should be developed using the approach proposed in the NPRM. In responding to the petition, the FAA pointed out that while the NPRM proposed to eliminate the specific reference to a change to engines using different principles of propulsion, that kind of change normally would be considered so extensive that a substantially complete investigation of compliance would be required. Thus, it should be noted that new § 21.19 does not necessarily change how one would evaluate "extensive" in each case. Instead, new § 21.19 eliminates the legal presumption that certain changes are automatically "extensive."

Current § 21.19(c) describes another specific change in which the applicant must apply for a new aircraft engine type certificate. This change is in the principle of operation. In addition, current § 21.19(d) describes specific changes in which the applicant must apply for a new propeller type certificate. The NPRM proposed to delete these types of changes from § 21.19. Under proposed § 21.101, with certain exceptions, these types of changes and all areas, systems, components, equipment, and appliances affected by the changes would have to comply with the regulations in effect on the date of application for the change to the type certificate.

Comments: CAA recommends that this section (§ 21.19) be cross-referenced in § 21.101(a).

One commenter recommends that wing modifications be added to the list of design changes listed in the preamble. This would be written as: "New wing (external geometry, structure, and performance.)"

FAA Response: The CAA comment is discussed under § 21.101(a). The list of design changes typically regarded as substantial that were referenced in the NPRM preamble have not been included in this document. However, they will be addressed in the forthcoming Advisory Circular. Section 21.19 is adopted as proposed.

#### Section 21.101(a)

Current § 21.101(a) states that if a person applies for a change in a type certificate, the product must comply with either the regulations referenced in the type certificate or the applicable regulations in effect on the date of the application for the change, if elected by the applicant, plus any other amendments the Administrator finds to be directly related.

In Notice No. 97-7, the FAA proposed to amend § 21.101(a) to require an applicant for a change to a type certificate to comply with the applicable regulations in effect on the date of the application for the change and with parts 34 and 36, unless the applicant falls within one of the exceptions that would allow compliance with an earlier amendment. The primary purpose of this proposed change was to ensure that products being changed in a significant manner meet the latest airworthiness standards wherever practicable.

Under this approach, the starting basis is the applicable regulations in effect on the date of the application for the change. The burden is on the applicant to prove that compliance with earlier regulations would provide an acceptable safety level. Under the current regulation, the starting basis is the regulations incorporated by reference in the type certificate. In this case, the burden is on the FAA to find that later amendments are directly related to the proposed change, or that there are other reasons (e.g., the regulations incorporated in the type certificate do not

provide adequate standards with respect to the proposed change) for requiring compliance with later amendments.

The FAA points out that current part 21 and amendments resulting from this rulemaking, only address "major" type design changes under § 21.93. "Minor" design changes are "approved" under § 21.95, and are not considered to be the changes to a type certificate that are covered under § 21.101.

Comments: The comments that address the substantive issue of the safety justification for, and potential cost of, changing from an original or previously amended certification basis approach to a current amendments approach were addressed earlier in the General and Miscellaneous Comments section of this preamble.

The CAA says that § 21.101(a) should be amended to cross reference § 21.19 to clarify that this section applies only when a new type certificate is not required under § 21.19. The CAA suggested rewording the paragraph to read as follows:

Where the Administrator finds that an application for a new type certificate is not required under § 21.19 and except as provided in paragraph (b)....

Raytheon recommends that proposed paragraph (a)(1) of § 21.101 be rewritten so that the word "and" after the term "changed product" is deleted.

FAA Response: The FAA does not agree with the CAA's suggested rewording as § 21.19 stands on its own and there is no need for a cross-reference to it in § 21.101. As rewritten, the "and" in § 21.101(a)(1) is not included. The general phrase, "airworthiness requirements applicable to the category of product" has been substituted for the references to parts 23, 25, 27, 29, 31, 33, and 35. As adopted, § 21.101(a), with minor revisions for clarification, replaces proposed § 21.101(a)(1) and (2) without substantive changes..

#### Section 21.101(b)

Proposed § 21.101(b) provided exceptions to the regulation in proposed paragraph (a), that, when met, would allow the applicant to comply with earlier amendments to the regulations. When choosing the amendment level of a regulation, all regulations associated with any relevant paragraphs in that amendment level would have to be included. The amendment level chosen may not predate either the latest certification basis or anything required by the retroactive sections, that is, §§ 23.2, 25.2, 27.2, or 29.2.

The intent of the proposed change was to apply the applicable regulations in effect on the date of the application to those areas, systems, components, equipment, and appliances significantly affected by the change, unless the Administrator finds that compliance with a regulation would not, (1) contribute materially to the level of safety of the changed product, or (2) would be impractical. For those areas, systems, components, equipment, and appliances not significantly affected by the change, or otherwise excepted, continued compliance with the regulations incorporated by reference in the type certificate would be considered acceptable.

Proposed paragraph (b)(1) stated that the applicant would be allowed to demonstrate compliance with earlier regulations, but not earlier than the regulations incorporated in the latest certification basis, if the effect of the proposed change is not significant, taking into account earlier design changes and previous updating of the type certification basis.

Proposed paragraph (b)(2) stated that the applicant may show compliance with earlier regulations for those areas, systems, components, equipment, and appliances that are not affected by the change.

Proposed paragraph (b)(3) stated that, if compliance with a regulation in effect on the date of the application for the change would not contribute materially to the level of safety of the product to be changed, or would be impractical, the applicant may demonstrate compliance with an earlier amendment of a regulation provided that the amended regulation does not precede either the corresponding regulation in §§ 23.2, 25.2, 27.2, or 29.2 of this chapter, or the corresponding regulation incorporated by reference in the type certificate.

A proposed advisory circular contained a safety benefit resource evaluation guide, which was recommended by the ARAC to be an acceptable means of compliance with the "impractical" exception of proposed § 21.101(b)(3), but which was included by the FAA for purposes of information only.

For the reasons discussed in more detail below, proposed § 21.101(b) is adopted with minor clarification changes, but without substantive changes.

Comments: Erickson Air-Crane Co. recommended a change in the wording of the rule to make it clearer that "You don't comply with the amendment alone, but rather the entire regulation at a given amendment level."

FAA Response: The FAA does not agree that an applicant would always have to comply with an entire amendment level. The proposal was to require compliance only with the relevant portions of a particular amendment level.

Comments: CAA states that the objective of the certification policy for changed products should be to ensure, as far as is practicable, that a changed product will achieve the same level of safety as a new product introduced concurrently. CAA states that the proposal, Notice No. 97-7, will not achieve this objective for the following reasons:

(a) The proposed § 21.101(b)(2) allows areas not affected by the change being considered to continue to use superseded airworthiness requirements, some of which may have been amended with the objective of improving the general level of safety. The fact that a product is a changed product, rather than a new product, should not be the reason for allowing it to continue to use outdated safety standards indefinitely. Even for areas not affected by the changes there needs to be a point beyond which a changed product is required to comply with the latest standards where amendments have been made as part of an initiative to improve general safety levels in such areas.

(b) The proposed § 21.101(b)(3) allows the continued use of superseded airworthiness requirements where compliance "*would not contribute materially to the safety of the changed product.*" Although NPRM 97-7 acknowledges the need to assess the accumulative effect of a number of small changes on the level of safety, the text of Paragraph (b)(3) is written in terms of the effect of a single change... there is a need to establish the datum as the original design standard of the product originally certificated.

CAA believes that § 21.101(b) is difficult to understand and should be re-drafted and cross-referenced to paragraphs (b)(1), (b)(2), and (b)(3).

CAA comments, as it did on the JAA proposal that the phrase "For each area, system, component, equipment, or appliance" should be replaced with "For each feature of the product." CAA acknowledges that this change, if adopted, would require extensive interpretive material to clarify what the word "feature" means.

FAA Response: There is very little language difference, and no substantive difference, between the FAA's proposed rule language and the language in JAA's NPA 21-7. Nonetheless, for reasons discussed below, § 21.101(b) has been rewritten for clarification. The ARAC working group had numerous discussions as to the meaning of "nonsignificant" in the proposed rule. The working group focused particularly on the draft Advisory Circular (AC) circulated for public comment at the same time as Notice No. 97-7 because the draft AC contained language explaining "nonsignificant." The ARAC recommended that some of the proposed AC language be included in the final rule to make it clear, in determining whether a change would be nonsignificant, that an applicant would go back to the latest certification basis and not the original certification basis. The draft AC provided that the following are nonsignificant:

"Changes that do not modify the general characteristics of the product in that: (1) The general configuration and principles of construction are retained; and (2) The assumptions used for certification of the basic product remain valid and the results can be extrapolated to cover the changed product."

In view of the ARAC discussions, the FAA has decided that it would be helpful to use the affirmative term "significant" rather than the negative term, "nonsignificant" and to more fully explain in the rule itself the term "significant." As adopted § 21.101(b)(1) reads as follows:

(b) If paragraphs (b)(1), (2), or (3) of this section apply, an applicant may show that the changed product complies with an earlier amendment of a regulation required by paragraph (a) of this section, and of any other regulation the Administrator finds is directly related. However, the earlier amended regulation may not precede either the corresponding regulation incorporated by reference in the type certificate, or any regulation in §§ 23.2, 25.2, 27.2, or 29.2 of this chapter that is related to the change. The applicant may show compliance with an earlier amendment of a regulation for any of the following:

(1) A change that the Administrator finds not to be significant. In determining whether a specific change is significant, the Administrator considers the change in context with all previous relevant design changes and all related revisions to the applicable regulations incorporated in the type certificate for the product. Changes that meet one of the following criteria are automatically considered significant:

- (i) The general configuration and the principles of construction are not retained; and
- (ii) The assumptions used for certification of the product to be changed do not remain valid.

This language should help both the applicant and the FAA reviewer to determine whether the effect of a change is significant, when considered in context with all previous changes to the design and all related changes to the latest "certification basis." Again, the overall intent of this rulemaking is to ensure that products developed through a series of changes, achieve a level of safety similar to that of a comparable new product. The final rule language makes it clear that, in determining whether a change is significant, the FAA will consider the latest amendments to the airworthiness standards adopted after the most recent type certification basis.

This is particularly important because a subsequent amendment of a regulation can indicate an important change in the emphasis in an area of the regulations. For example, if the regulations have been amended in an affected area, then the assumptions used for certification of the product may no longer be valid. The FAA considers these changes in the rule language to be

clarifying since they are consistent with the intent of Notice 97-7 and with the explanations given in the accompanying draft Advisory Circular.

Comments: One commenter states that the FAA should reconsider its proposal to delete the existing § 21.101(b)(1) that allows the FAA to apply later regulations without regard to the exceptions in proposed § 21.101(b)(1), (2), and (3). This commenter provides an example of a transport category airplane with an early certification basis built with independent round dial instruments. The commenter notes that a number of rules were added that applied to replacing independent round dial instruments with a multifunction display or an electronic flight instrument system. The commenter suggests that the proposed rule would preclude compliance with the added rules for that kind of design change.

This commenter suggests that proposed § 21.101(b)(3) is not an improvement over the issue paper process, where that applicant would have an opportunity to apply for an exemption from the rule, which the applicant did not agree with, through a public notice process.

This commenter also expressed concerns regarding the use of the service history of an already changed product when analyzing the "impractical" exception to application of the latest regulations to a change of that product. Specifically, the commenter is concerned that, when a later rule addresses hazards or failures in very small probabilities and a product change is certificated using that later amendment, the older version of that product may have not yet reached the total exposure to the hazard or failure addressed by the later rule. In this case, the service history of the older version of the product would "bask in the glow" of the uneventful service history of the newer version that complies with the later amendment, making it appear that compliance with the latest amendments would be unwarranted.

Additionally, this commenter states that the preamble discussion of "impractical" mentions both a cost analysis and a benefit-resource evaluation and states that the applicant will only be able to provide a cost analysis and that there would not be enough data to make a comparison.

This commenter does not believe the use of a cost/benefit analysis to be practical as a tool to determine if a later rule should be applied under the proposed § 21.101. The commenter states that if such an approach is used then the FAA should at least eliminate the proposed AC Appendix 2 as it appears biased and without justification.

The ARAC working group had numerous discussions on the limited applicability of the data in Appendix 2 of the draft AC because this data was drawn from, and therefore only applicable to, transport category airplanes. The ARAC recommended that data be developed for other airplanes and for rotorcraft. The ARAC also recommended delayed compliance dates to allow time for development of this data.

FAA Response: The FAA construes the first comment to mean that the exceptions in proposed § 21.101(b)(1), (2), and (3) are too broad, so as to overly limit FAA discretion to impose later requirements. With respect to the example, the FAA notes that such a design change would be significant, and that it would be difficult, if not impossible, for the applicant to demonstrate that one of the exceptions applies. Therefore, compliance with the later regulations would most likely be required. The FAA has found that the public interest is satisfied by limiting the situations of required compliance with the latest airworthiness standards to each significant change, each area affected by the change, and each instance where compliance would contribute materially to the level of safety of the product and would be practical. In addition, special conditions may be required in accordance with the existing regulations. Nothing more is necessary for the safety enhancement of changed products.

Regarding the second comment, proposed § 21.101(b)(3) was not intended to replace the issue paper process, but to change the standards of certification, allowing an applicant to use earlier regulations if compliance with the latest regulation has been determined to be impractical or would not contribute to the level of safety. An individual's right to request an exemption from any rule has not been eliminated. As a result of the issue paper process, the applicant may still decide to petition for an exemption. This final rule does not change the applicant's ability to apply for that exemption.

The commenter's concerns with respect to service history are unwarranted. First, as was noted in the preamble to the NPRM, the service history that would be considered in deciding whether to invoke an exception to compliance with a later amendment would be the *applicable* service experience. In the case cited by the commenter, the relevant, service experience applicable to a change to the later version of the product would be the service experience of that later version, which complies with the later amendment. The relevant, service experience applicable to a change to the older version of the product would be the service experience of that older version, which doesn't comply with the later amendment. Second, as explained in this preamble and the preamble to the NPRM, the starting point of the analysis in determining whether the latest amendments should be applied to an already changed product is the changed product's latest certification basis.

In response to the last comment, the preamble to Notice No. 97-7 referenced a safety benefit resource evaluation guide as part of the draft advisory circular. The guide was developed by the Aviation Rulemaking Advisory Committee, and was included in the draft circular for information purposes only. In consideration of comments received and after further discussion with the ARAC, the FAA has determined that, in theory, a safety benefit resource evaluation guide could be used by the applicant to demonstrate that compliance with the later amendment would be impractical. An applicant who elects to make a showing using this guide would be required to submit data on potential benefits and costs that would justify compliance with an amendment level in effect before the date of the application for a change. As mentioned earlier, the burden of the initial showing of costs and benefits rests with the applicant. The FAA will consider the analysis along with other factors in its assessment and determination of the appropriate amendment level. A safety benefit resource evaluation guide, therefore, will likely be retained in the final advisory circular as a tool to assist the applicant in developing arguments as to the appropriate certification basis.

The safety benefit resource evaluation guide recommended by the ARAC could not be endorsed as a sole means of determining the amendment level because the process cannot be proven through any rational financial analysis determination. In addition, the guide includes factors that are not relevant in determining applicable regulations. For example, the guide suggested a change to a single production item could be certificated differently than the same change to multiple production items. In determining whether a regulation should apply, the FAA considers the level of safety, not the quantity of production items as the basis.

Comments: AECMA states that few of the changes proposed during the life of a product are really significant and that therefore, it is an administrative burden to require elaboration and documentation of a justification for application of one of the exceptions in § 21.101(b) for each change. This commenter emphasized an established procedure described in the Action Notice A8110.23, "requiring application of the latest requirements only for changed parts of the product and affected area warranted equivalent results with less bureaucratic burden."

FAA Response: FAA's Action Notice 8110.23, which was replaced by Order 8110.4, was an interim action intended to move applicants in the direction of the regulations in effect on the date of the application for a change. Neither document has, nor were they intended to have, the



regulatory impact of the rule language proposed in Notice No. 97-7. These documents were, however, directed at all derivative aircraft, engines, and propellers where a change is significant, but not so extensive as to require a new type certificate. The action notice and subsequent order applied to all changed products whether the approval method was an amended type certificate or an STC.

Comments: Raytheon states that the intent of the word "impractical" in proposed § 21.101(b)(3) "should be defined as not providing added value (perceived or actual) to the operator, manufacturer, or traveling public, or not achieving the desired effect, as in *non-meritorious or ineffectual*." Raytheon suggests, "Perhaps impractical could be defined as 'without value enhancement,' to stress that any change required as a result of a new regulation which doesn't result in a value enhancement may, with analytical substantiation, be exempted from compliance."

FAA Response: There is little, if any, difference between the FAA's explanation of compliance that would not contribute materially to the level of safety and Raytheon's understanding of compliance that would be "impractical." The question of whether compliance with a later regulation would be impractical arises only after it has been determined that compliance with the later regulation would "contribute materially to the level of safety of the changed product...." The cost burden introduced by impracticality is considered in relation to the potential safety benefit. In order to show impracticality the applicant considers whether the cost to incorporate the change, plus the cost of the subsequent operation of the changed product, would not be commensurate with the potential increase in safety.

Comments: One commenter states that if an applicant is granted an exception under proposed § 21.101(b)(2) (unaffected areas) it should be subject to mandatory periodic FAA reviews of safety related issues for airplanes that continue in production under the same type certificate. This commenter states that for airplanes that have continued in production for many years and at substantial quantities, the claim of excessive economic burden may be invalid and that a reasonable time period for periodic reviews would be ten years, starting from the date the exception was first granted. The commenter recommends that mandated changes should be incorporated in newly produced airplanes within three years after the review. Furthermore, the FAA should consider expected size of the future market when considering granting an exception for production airplanes.

On the topic of "impractical" this commenter believes the concept is acceptable, although balancing safety with economics is not something readily acceptable to the public at large. The commenter states "cost-effective/not cost-effective" should be used instead of "practical/impractical" since the latter terms are too broad and not descriptive of the concept.

FAA Response: Since the basis for an exception under proposed § 21.101(b)(2) is a finding that the area, system, component, etc. is not affected by the change, the FAA does not agree that there is a need for a periodic review of the ground for the exception, nor does the FAA agree that economic burden is a factor in this determination. With respect to whether compliance with the later regulation would be impractical, the FAA cannot agree that the terms "cost effective/not cost effective" would be more descriptive. While costs and benefits stated in dollar terms are essential ingredients, a safety benefit resource analysis involves more than costs.

The benefit-resource analysis is a composite evaluation of four elements that are key to determining the contribution to safety made by meeting a particular rule. The four critical elements are:

- (1) The frequency of occurrence of the hazard the rule is intended to mitigate.

- (2) The potential severity of the hazard.
- (3) How well the configuration being certificated will mitigate the hazard by meeting the rule.
- (4) What resources are required if the design must meet the rule.

While cost is one element of this evaluation, all four elements must be considered in evaluating the application of a rule. Furthermore, because application of the rule will set appropriate standards for the product design and the design change, the concern of the comment regarding length of production where no design change is proposed is beyond the scope of this rulemaking.

#### Section 21.101(c) (New)

Section 21.101(c) in this final rule contains the previously mentioned exceptions for aircraft (other than rotorcraft) of 6,000 pounds or less maximum weight, as defined in § 23.25(a), and non-turbine rotorcraft of 3,000 pounds or less maximum weight, as defined in § 27.25(a). Inclusion of these exceptions will address some of the concerns expressed by the aircraft modifiers who commented on Notice No. 97-7.

The primary impact of the exception language in § 21.101(c) will be that the starting point for determining the applicable regulations for a changed product will continue to be, as in current § 21.101, the regulations incorporated by reference in the type certificate, rather than the regulations in effect on the date of application for the change. To ensure that later regulations are applied when appropriate, § 21.101(c) contains language that allows the administrator "to designate an amendment to the regulation incorporated by reference that applies to the change and any regulation that the Administrator finds is directly related, unless the Administrator also finds that compliance with that amendment or regulation would not contribute materially to the level of safety of the changed product or would be impractical."

Thus, as adopted, for the excepted aircraft the starting point for determining the applicable regulations will be the latest certification basis rather than those regulations in effect on the date of application for the change. In this case, the FAA would make the finding that applying later amendments is necessary. The later amendments would not be applied, however, if the Administrator also finds that one of the exceptions applies. This part of the rule, like other regulations, leaves the burden on the applicant to demonstrate that compliance with those later amendments would not contribute materially to the level of safety, or would be impractical. For example, the burden is on an applicant for a pilot certificate to provide the evidence on which the Administrator finds that he or she is qualified to hold a certificate.

Historically FAA and its predecessor agencies have treated light airplanes and small non-turbine rotorcraft differently from other classes of aircraft. Aircraft of 6,000 pounds or less maximum weight and non-turbine rotorcraft of 3,000 pounds or less maximum weight are usually of less complex design than the larger aircraft. In addition design changes to these aircraft usually are of less complexity. Furthermore, the certification requirements for these aircraft are many times less complex than those for larger aircraft. Examples of this are simplified design load criteria and performance requirements.

The exception in § 21.101(c) is premised on the assumption that the lesser complexity of design, design changes, and requirements will allow the FAA Aircraft Certification Office (ACO) to more easily identify the current airworthiness standards appropriate for the areas of the product affected by the proposed change. Nonetheless, § 21.101(c) also allows the applicant to submit data on which the ACO could decide to allow one or more of the exceptions to requiring the latest airworthiness standards.

Most importantly, although the process for determining the appropriate level of safety for these aircraft and rotorcraft will be different from the more complex large aircraft, the final result should be the same. The level of safety for both types will be enhanced because the most appropriate airworthiness standards will be used.

#### Section 21.101(d)

Section 21.101(d) (proposed § 21.101(c)) retains the provisions of current § 21.101(b)(2) concerning special conditions. This paragraph addresses novel or unusual design features where the Administrator finds that the regulations incorporated by reference in the type certificate do not provide adequate standards. For a product that has a novel or unusual design feature, the applicant must comply with the regulations in effect on the date of the application for the change and any necessary special conditions "to provide a level of safety equal to that established by the regulations incorporated by reference in the type certificate for the product." For consistency with the other proposed changes to § 21.101, this proposed paragraph stated that an applicant for a change must comply with any special conditions, and amendments to those special conditions, if any, that provide a level of safety equal to that established by the regulations in effect on the date of the application for the change.

The provisions of current § 21.101(c), concerning the replacement of reciprocating engines with turbopropeller engines, have been removed because a change of this nature would usually be considered a significant change, and compliance with the regulations in effect on the date of application of the change would, therefore, be required.

Comments: CAA recommends that the words "established by the regulations" be replaced with the words "intended by the regulations."

FAA Response: The phrase "intended by the regulations" is not appropriate rule language. Except for the change from paragraph (c) to paragraph (d) this section is adopted as proposed.

#### Section 21.101(e)

Section 21.101(e) (proposed § 21.101(d)) sets a limit of five years on an application for a change to a type certificate for a transport category aircraft, and sets a limit of three years on an application for a change to a type certificate for all other products. The durations for these amended or supplemental type certificate applications are the same as those for applications for the corresponding type certificates. If an application for a design change expires, an applicant may file a new application or apply for an extension of the original application as provided in § 21.17(c) and (d).

This section is adopted as proposed, except that paragraph (e)(2) has been clarified. New paragraph (e)(2) allows the applicant to select a new date. The new application date may not precede the date the change is approved by more than the time period established under paragraph (e). For example, a person applies for a change to a transport category airplane in 2000. In 2003, the applicant decides that the project cannot be completed by 2005 (the time period required by paragraph (e)). The applicant, however, decides that the project can be completed by 2007. Under paragraph (e)(2), the applicant may elect 2002 (2007 minus 5 years equals 2002) as the new certification basis date.

#### Section 21.101(f)

Section 21.101(f) (proposed §§ 21.101(e)(1) and (2)) requires the certification basis for a change to a product certificated under predecessor regulations be established in the same manner

as that for a change to a certification basis for a product certificated under parts 23, 25, 27, 29, 31, 33, or 35.

Changes to products type certificated under §§ 21.21 and 21.29 and changes to aircraft type certificated under §§ 21.24, 21.25, 21.27, as well as special classes of aircraft (where regulations from the airworthiness standards listed in Chapter 1 are a part of the certification basis) would be required to comply with the requirements of § 21.101(a).

**Comments:** Pratt & Whitney Canada states that neither the proposed Canadian regulation nor the related JAA NPA 21-7 contain requirements similar to this proposal and recommends that the FAA consider tasking ARAC to address this issue in the interest of harmonization, if a safety concern exists.

Bombardier and Transport Canada believe extending the applicability of this requirement to restricted category aircraft (§ 21.25) would be contrary to the ARAC recommendation. Bombardier advises that the ARAC proposal excluded this category of aircraft because "compliance with the 'applicable' regulations (whether earlier or latest) was not required for the original model when justified with the regulating Authority."

The Aerospace Industries Association (AIA) asserts that § 21.101(f) (proposed § 21.101(e)) contains the same requirements as § 21.101(a). AIA believes these sections "make no exception for products originally certificated to regulations that existed prior to the codification of the applicable part(s) of 14 CFR nor for products certificated as restricted, surplus military, or other unique types." AIA recommends this proposal be eliminated.

Transport Canada recommends the paragraph be revised in a manner similar to proposed § 21.101(a)(1), which specifically states "each regulation that is applicable to the changed product."

**FAA Response:** The intent of proposed paragraph (e)(1) was to ensure that the predecessor regulations (former CAR's, etc.) would continue to be the starting basis for aircraft that were originally type certificated under earlier regulations. The recodification of the regulations did not remove airworthiness requirements under which products were type certificated. Therefore, the FAA agrees, in part, with AIA in that proposed paragraph (e)(1) is redundant. Proposed paragraph (e)(1) has not been adopted.

However, § 21.101(f)(proposed § 21.101(e)(2)) is still needed to address aircraft type certificated under §§ 21.24, 21.25, 21.27, and special classes of aircraft covered by § 21.17(b). The airworthiness requirements applicable to the category of aircraft in effect on the date of the application for the change must include any airworthiness requirements that the Administrator finds to be appropriate for the type certification of the aircraft in accordance with those sections.

The FAA has determined that some restricted category aircraft should comply with the requirements of this rulemaking action and the reference to § 21.25 has been retained. Although Transport Canada has somewhat comparable "restricted category" provisions in their regulations, the JAA have no comparable provisions in their regulations. However, the FAA does certificate some restricted category aircraft using airworthiness standards and has determined that this requirement is needed to ensure that the aircraft certificated using regulations from parts 23, 25, 27, and 29 are included in the rule. The requirements of proposed § 21.101(e)(2) have been revised and retained as § 21.101(f) in the final rule. Due to the revision of § 21.101(f), the language to which Transport Canada referred is no longer in the paragraph.

#### Section 21.115

A type certificate holder may obtain approval for a change by amending the original type certificate under § 21.101, or by obtaining a supplemental type certificate under § 21.115. Other

modifiers must obtain supplemental type certificates under § 21.115. Because the provisions of § 21.115 incorporate by reference the provisions of current § 21.101(a) and (b), the provisions to amend the type certificate are essentially the same as the provisions for supplemental type certificates. To align the provisions of proposed changes to § 21.101 and appropriate references to those changes in proposed § 21.115, the paragraph designators (a) and (b) have been removed.

By deleting the paragraph designators the FAA, in effect, proposed to require applicants for a supplemental type certificate to show that the modified product complies with the applicable regulations in effect on the date of the application for the STC is met.

Comments: Virtually all of the commenters who commented on proposed § 21.115 (including the oral comments from the in-service modifiers represented at the ARAC working group meetings) opposed this proposal and the substantive change proposed in § 21.101(a) that requires that STC applicants make a finding of compliance with later applicable regulations. These commenters recommend no changes to the current requirements for an STC.

FAA Response: As mentioned earlier under the discussions in § 21.101(b), the FAA has provided an exception, in § 21.101(c), for aircraft of 6,000 pounds or less maximum weight and non-turbine rotorcraft of 3,000 pounds or less maximum weight. The primary impact of this exception will be that the starting point for determining the applicable regulations for a changed product will continue to be the regulations incorporated by reference in the type certificate. The administrator may designate an amendment to the regulation incorporated by reference that applies to the change and any regulation that the Administrator finds is directly related, unless the Administrator also finds that compliance with that amendment or regulation would not contribute materially to the level of safety of the changed product or would be impractical.

The exception applies to both amended and supplemental type certificates. This is because there is no legal difference between the number of products that can be modified using an amended type certificate versus using supplemental type certificates.

### Section 25.2

Current § 25.2(c) incorporates by reference the provisions of current §§ 21.101(a) and (b) concerning special retroactive requirements applicable to airplanes for which the regulations referenced in the type certificate predate subsequent amendments. Section 25.2(c) has been revised consistent with the changes to § 21.101(a).

Comments: Raytheon believes that §§ 23.2, 27.2, and 29.2 should be amended to use the same language as § 25.2.

FAA Response: Current §§ 23.2, 27.2, and 29.2 do not contain references to § 21.101 no change is needed in these sections.

### **Paperwork Reduction Act**

This rule contains information collections that are subject to review by OMB under the Paperwork Reduction Act of 1995 (44 U.S.C. section 3507(d)). As previously stated, comments on the information were not invited at the proposed rule stage and therefore are being invited in this final rule document. The Department of Transportation has submitted the information requirements associated with this rule to the Office of Management and Budget (OMB) for its review. The title, description, and number of respondents, frequency of the collection, and estimate of the annual total reporting and recordkeeping burden are shown below.

**Title:** Type Certification Procedures for Changed Products.

**Summary:** This rule will constitute a reporting burden for applicants seeking an amended Type Certificate or a Supplemental Type Certificate for changes to aeronautical products. This rule requires applicants, with some exceptions, to comply with the latest regulations in effect on the date of the application for the design changes of aircraft, aircraft engines, and propellers. Compliance with the latest regulations will not be required:

- (1) if the change is not significant,
- (2) for those areas or components not affected by the change,
- (3) if such compliance would not contribute materially to the level of safety, or
- (4) if such compliance would be impractical.

The applicant for most product changes now will incur an additional incremental administrative cost to document an analysis based on the latest certification basis and identify to the FAA those regulations they will or will not be complying with, based on the above four criteria. This analysis is part of the applicant's compliance review document.

Applicants for product changes to non-turbine rotorcraft of 3,000 pounds or less maximum weight, or other aircraft of 6,000 pounds or less would not necessarily be required to perform this analysis. For such applications, the FAA would make an initial finding to require compliance with appropriate regulations. In that case, the applicant may decide to demonstrate compliance with those regulations, or may perform the analysis to demonstrate that compliance is not warranted.

**Use of:** Because the rule shifts most of the responsibility from the FAA to the applicant to evaluate and demonstrate the applicable certification basis for product changes, the applicant must produce additional documentation when submitting an application to the FAA. The FAA will review all documentation provided with the amended TC or STC application and determine the certification basis for the changed product.

**Respondents:** Any individual or business entity desiring to submit an application for a change to a TC or an STC; i.e., a current TC or STC holder, a manufacturer, or a modifier of aeronautical products.

**Frequency:** Approximately 2,860 applications are received by the FAA annually. Of these, an average of 1,649 applications per year result in certificates being issued. The difference of 1,211 applications per year represents an estimate of the applications that are initiated but are never completed; e.g., withdrawn, canceled, or inactive. The sum of the 1,649 annual applications completed for certification, and 75 percent of the 1,211 applications not completed, equals the administrative equivalent of 2,557 applications per year.

**Annual Burden Estimate:** The full regulatory evaluation forecasts costs over a 20-year period, beginning in the year 2000, and assumes a 3 percent annual increase in applications. For all applicants, the first year administrative costs of the rule are projected to equal \$1,975,530 (1998 present value \$1,725,504) divided by an overhead rate of \$105 an hour, which equals 18,815 total annual hours.

Using the 1500-employee size standard, small firms are projected to incur 56.6 percent of those costs, equaling \$1,118,679 with a 1998 present value of \$977,098. The small business proportion of expected administrative costs (56.6 percent) is lower than the proportion of applications expected from small business (62.1 percent) because a significantly higher proportion of the administrative exceptions under the rule are projected for small business applicants. This disproportionate exception rate also causes the average increased administrative cost per small business application (\$664) to be smaller than the average for all applicants (\$728.)

For the 20-year study period, incremental small business administrative costs under the rule are projected to total \$30,059,321 with a 1998 present value of \$13,938,179.

The agency solicits public comment on the information collection requirements to:

- (1) evaluate whether the collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;
- (2) evaluate the accuracy of the agency's estimate of the burden of the collection of information, including the validity of the methodology and assumptions used;
- (3) enhance the quality, utility, and clarity of the information to be collected; and
- (4) minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, (e.g., permitting electronic submission responses).

Individuals and organizations may submit comments on this information collection requirements by [insert date 60 days after publication in the Federal Register], and should direct them to the address listed in the ADDRESSES section of this document.

Persons are not required to respond to a collection of information unless it displays a currently valid OMB control number. The burden associated with this rule has been submitted to OMB for review. The FAA will publish a notice in the Federal Register notifying the public of the approval number.

Information collection requirements to other sections of part 21 have previously been approved by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. § 3507(d)), and have been assigned OMB Control Number 2120-0018.

### **International Compatibility**

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable.

The FAA has reviewed corresponding ICAO Standards and Recommended Practices and Joint Aviation Airworthiness Authorities regulations, where they exist, and has identified and discussed similarities and differences in these proposed amendments and foreign regulations.

The final rule results, primarily, from a recommendation harmonized with the aviation authorities of Canada and Europe. Transport Canada and the Joint Aviation Authorities have proposed similar corresponding changes to regulations governing type certification procedures for changed products.

### **Economic Evaluation, Regulatory Flexibility Determination, International Trade Impact Assessment, and Unfunded Mandates Assessment**

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980, as amended, requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (19 U.S.C. §§ 2531-2533) prohibits agencies from setting standards that create unnecessary obstacles

to the foreign commerce of the U.S. And fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4) requires agencies to prepare a written assessment of the costs, benefits and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of \$100 million or more annually (adjusted for inflation).

In conducting these analyses, the FAA has determined that this rule: (1) would generate benefits that justify its costs; and is "a significant regulatory action" under Executive Order 12866 and under the regulatory policies and procedures of the Department of Transportation (44 FR 11034, February 26, 1979), (2) would have a significant economic impact on a substantial number of small entities; (3) would not constitute a barrier to international trade; and (4) does not contain a significant intergovernmental or private sector mandate. These analyses, available in the docket, are summarized below.

#### Response to Economic Comments

Comment: The Air Transport Association (ATA) and a private aircraft owner both raise due process concerns based on the failure of the FAA to quantify the costs and benefits of the proposal in the Notice of Proposed Rulemaking (NPRM). While the NPRM stated that the FAA was not able to quantify the costs and benefits of this proposal, the NPRM also stated that the benefits would exceed the costs. In previous rulemakings the FAA was able to justify part 25 amendments applicable to new type designs, but failed to satisfy reasonable cost-benefit criteria essential to making them applicable to derivatives, new production units, or the existing fleet. Based on this, ATA doubts that the benefits of the proposal exceed the costs, and, in general, holds that government should not adopt regulations for which the costs and benefits have not been quantified.

FAA Response: The FAA's assessment that the proposed rule would be cost-beneficial was, and is, based on the provision of the rule that, in the final instance, compliance with later regulations will not be required if such compliance "...would not contribute materially to the level of safety of the changed product or would be impractical." In the discussion of this provision, the NPRM further explained that "compliance with a later amendment would be considered 'impractical' when the applicant can establish that the cost of the design change and related changes necessary to demonstrate compliance with the amendment would not be commensurate with the resultant safety benefit."

Executive Order 12866, which is the basis for federal regulatory evaluation, explicitly recognizes that costs and benefits may not always be quantifiable. The Order states that, "costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider."

#### Discussion of Costs and Benefits

The costs imposed by the final rule will be incurred by future applicants for amended and supplemental type certificates for aeronautical products. Two categories of costs may be imposed: (1) administrative costs, and (2) the costs of compliance with later regulations.

The final rule will require applicants to comply with the regulations in effect on the date of the application for the change, as compared to the latest certification basis of the product to be changed, unless one of several conditions is met. Compliance with the later set of regulations will not be required:

- (1) if the change is not significant,



- (2) for those areas or components not affected by the change,
- (3) if such compliance would not contribute materially to the level of safety of the changed product, or
- (4) if such compliance would be impractical; i.e., would result in costs that would not be commensurate with the safety benefit that would be derived.

Applicants for changes to most products would incur the incremental administrative cost of evaluating and demonstrating to the FAA the applicability of these four conditions to their product changes. The final rule, unlike the proposed rule, would make an exception to this administrative responsibility for applicants for changes to either: (1) non-turbine rotorcraft of 3,000 pounds or less maximum weight, or (2) other aircraft of 6,000 pounds or less. For such applications, the FAA would maintain the administrative responsibility of demonstrating that the certification basis for a changed product should incorporate the latest airworthiness standards.

#### Survey Methodology

The evaluation of this rule was based on a sample of records from the FAA's Aircraft Certification Office Subsystem (ACOS) database. The ACOS system is used to track FAA certification projects at the individual certification office level. All pertinent (amended and supplemental) certification actions, where the date of application was 1994 or later, were selected and combined into a single database. That filter resulted in a set of 13,448 project records, from which, a random sample of 250 project records were selected for detailed review and analysis. These sample project records were then used to forecast the expected distribution of characteristics for future amended and supplemental certification actions under the final rule.

The 250 sample project records were evaluated by a team of field-experienced FAA certification employees. Based on the data provided for each project in the sample, the review team assessed the following five areas for each sample record:

1. Categorized the number of employees in the firm submitting each application. This information was used to evaluate the potential effects of the rule on small entities.
2. Assessed the weight and type of the affected aeronautical product in order to estimate the proportion of applications that would fall within the final rule's specified exceptions for certain small aircraft.
3. Estimated the existing administrative effort for each application under current procedures.
4. Estimated the incremental administrative work that would be caused by the final rule. The review team also estimated the additional administrative work for those applications that would actually be excepted by the rule's small-aircraft provision. These estimates were needed to measure the amount of relief that would be afforded by this exception.
5. Estimated the proportional split between the certification projects that would and would not be required to meet later regulations. For those projects that would not be required to meet later requirements, the responses were used to measure the distribution of conditions that would lead to that determination. Conversely, for those projects that would be required to meet later regulations, these responses were used to categorize the relative cost impact of meeting those regulations.

For 227 of the 250 sample project applications, the ACOS data system contained sufficient information for the FAA review team to estimate answers for the five-part evaluations

described above. Insufficient data were available to assess the remaining 23 project records, which were removed and were not considered further.

### Costs

The following procedure was used to estimate the administrative costs of the rule. First, the sample data were tabulated to determine the proportional distributions of results for each item area in the sample. This distribution for the sample project applications was then expanded to represent the characteristics that would be expected for all affected applications in a year. The ACOS data show that an average of 2,860 applications for amended or supplemental type certificates are received into the system each year. Of these, an average of 1,649 applications per year result in certificates being issued. The difference of 1,211 applications per year represents an estimate of the applications that are initiated but are never completed; e.g., withdrawn, canceled, or inactive.

The regulatory evaluation assumes that the additional administrative efforts caused by the final rule would apply to all projects that are completed, and that 75 percent of that additional administrative effort would actually take place for the "never completed" projects. The sum of the 1,649 annual applications completed for certification, and 75 percent of the 1,211 applications not completed, equals the administrative equivalent of 2,557 applications per year. The projected numbers of applications, by category, were then computed by multiplying the percentage distributions of the sample data by this administrative equivalent of 2,557 applications per year.

Next, the annual increased hours of administrative work that will be caused by the rule was computed by multiplying the matrix of 2,557 applications by the respective average increases in administrative hours per application, as determined from the review team evaluations of Item 4. This methodology projects that the rule will impose a total additional 17,218 applicant hours of administrative work per year. By comparison, the rule's exception provision for small aircraft applications is projected to preclude an additional 3,985 hours of applicant administration from being imposed.

The increased annual administrative costs of the rule were then computed by multiplying the incremental administrative hours, from above, by a unit cost factor of \$105 per hour. This factor is intended to be a representative, fully burdened labor rate for the highest skill level necessary to make and support the determinations called for under the rule. These calculations project a base annual administrative burden of approximately \$1.8 million.

The administrative costs of the rule were then projected over a 20-year study period. For computational simplicity, all administrative costs were assumed to begin in the year 2000, even though the effective date of the rule will vary by product type. The computations assumed an annual 3 percent increase in certification applications, and accordingly, a 3 percent annual increase in attributable costs. The initial year 2000 cost was computed from the \$1.8 million base annual administrative burden described above and inflated at 3 percent annually from 1997 to the year 2000. These calculations predict that the 20-year administrative costs of the rule will total \$53.1 million, with a 1998 present value of \$24.6 million. Parallel calculations were made for the costs that will be excepted under the rule's provision for certain small aircraft. This exception will preclude an estimated \$12.3 million in applicant administrative costs over the study period, with a 1998 present value of \$5.7 million.

In addition to the administrative costs detailed above, additional costs will be imposed by the rule's conditional requirements for compliance with later certification regulations. It is important to note that the final rule's exception for small aircraft only applies to the administrative burden of proof under the rule. Accordingly, applications that are excepted from the rule's

incremental administrative costs may still incur the incremental costs of complying with later, and likely more stringent, regulations.

A second important difference between the calculations for administrative costs versus compliance costs concerns the base number of affected applications. The previous computations of administrative costs included a proportion (75 percent) of those applications that were never finalized, and where no amended or supplemental type certificate was issued. By comparison, any additional compliance requirements resulting from this rule would only apply in situations where an amended or supplemental type certificate is actually issued. As such, the compliance cost calculations are based on the average 1,649 amended and supplemental certificates issued each year, as reported from the ACOS data. Using this base number, the annual numbers of certifications that would be subject to the rule over the 20-year study period were forecast, based on a 3 percent growth rate.

The expected annual numbers of certification projects that would have to meet later regulations were estimated from the sample results. Item 5 from the team evaluation areas assessed the simulated effect of the rule on the certification basis of each sample project. The percentage distribution of that assessment follows.

<b>Percent of Samples</b>	<b>RULE WOULD NOT INVOKE LATER REGULATIONS</b>
49.3%	Change would be not significant.
9.7%	Change would not contribute materially to safety or would be impractical.
	<b>RULE WOULD INVOKE LATER REGULATIONS</b>
36.1%	Compliance costs would increase less than 10%.
3.5%	Compliance costs would increase 10%-25%.
1.3%	Compliance costs would increase over 25%.
100.0%	Total

This regulatory evaluation uses the three compliance impact level percentages to project the annual numbers of applications where later regulations would be invoked and additional compliance costs could result. Separate estimates were made for each of the three ranges of compliance impact. This procedure projected that, in the first year, cost increases of less than 10 percent would result from applying later regulations to 651 certification projects. Similarly, 64 projects were projected to incur cost increases of 11 to 25 percent, and 24 projects would have cost increases of over 25 percent. Annual impact estimates were projected over the entire study period through the year 2019, again assuming a 3 percent growth.

It would be informative to have more detailed compliance impact estimates than the broad categorizations of relative percentages that were possible using the sample review methodology employed in this evaluation. However, the scope of projects that will be affected by this rule is wide, and reliable measures of the sample project production levels were not available for this evaluation. Therefore, in an effort to provide useful information, without portraying a higher degree of confidence than is supportable, estimates were made of the future annual

compliance cost impacts of the rule per assumed \$100,000 unit of project size. This assumed average project size is a direct factor to the resulting projected compliance costs, and alternate assumptions are readily calculable.

While this analysis uses a compliance cost of \$100,000 for a single project, the FAA believes there is a wide range of compliance costs. For example:

1. A \$100 thousand dollar project. An emergency medical service system for a helicopter over 3,000 pounds. This modification includes a litter/restraint system, medical equipment (oxygen, ventilator, air pump, defibrillator, etc.), and an auxiliary electrical system.
2. A \$20 to \$50 thousand dollar project. An improved stainless steel exhaust system for a twin-engine general aviation aircraft.
3. A \$15 thousand dollar project. The purchase and installation of an avionics instrument system.

For a simple sensitivity test, the compliance cost estimate is directly related to changes in the assumed \$100,000 compliance cost per project. If, for example, the project cost for small business is better represented by \$20,000, then the compliance cost estimates should be reduced by 80 percent.

The unit-project-size cost estimates were computed as the product of: (1) the relevant number of annually affected projects described above, (2) an assumed median value for the percentage impact ranges at each of the three impact levels, and (3) the assumed \$100,000 unit project size. For example, the year 2000 cost estimate for projects in the less-than-10-percent cost impact category was computed as the product of:

- (1) the projected 651 affected projects from Table 7,
- (2) an assumed mid-range cost impact of 5 percent, and
- (3) the assumed unit project level of \$100,000.

This subcalculation produces a cost impact estimate of \$3,255,000 for projects in the "less-than-10-percent" cost impact category in the year 2000, as shown in Table 8. When applied to all 3 cost impact categories, and summed, this methodology produces an annual compliance cost impact of \$4.8 million in the year 2000. Total twenty-year compliance costs, at the \$100,000 unit project level, are projected to equal \$128.0 million, with a 1998 present value of \$59.4 million.

In summary, the 20-year administrative costs of the rule are projected to total \$53.1 million, with a 1998 present value of \$24.6 million. Parallel compliance costs, assuming a \$100,000 unit project level, equal \$128.0 million, with a 1998 present value of \$59.4 million. An additional \$12.3 million (\$5.7 million, 1998 present value) in applicant administration costs will be averted by the small-aircraft exception provision in the rule.

### Benefits

The directly attributable benefit of this final rule is the augmented safety that will result in those cases where future changed products will be required to comply with later, more stringent airworthiness standards than those that would be required in the absence of this rule. These benefits cannot be accurately predicted and quantified, but the rule includes provisions to assure that any actions taken pursuant to it will be cost-beneficial.

The benefits of amendments to the airworthiness standards are evaluated at the time of those amendments. Some amendments are based on the FAA's evaluation of accidents or incidents; other amendments are based on the FAA's evaluation of probable or likely safety

problems that may not be attributable to a specific accident. The changed products rule is FAA's proactive approach to addressing safety issues before they arise. The FAA does not have to wait for an accident to justify a rule.

As noted previously, the rule will require compliance with all later regulations where such compliance will contribute materially to the level of safety. The rule will not require compliance with later regulations: (1) if the change in the aeronautical product is not significant, (2) for those areas or components of the product not affected by the change, (3) if such compliance would not contribute materially to the level of safety of the changed product, (4) or in the final analysis, if such compliance would be impractical. Compliance with later regulations will be considered impractical if the applicant can show that such compliance would result in costs that are not consistent with the possible safety benefits. Since each action taken under the rule will be cost-beneficial, the FAA has determined that the benefits of the rule will justify its costs.

#### Smaller Aircraft Exception Provision

The exception in § 21.101 for non-turbine rotorcraft under 3000 pounds and for other aircraft under 6000 pounds places the burden on the FAA to make an initial determination whether or not to require the applicant to demonstrate compliance with a later airworthiness standard. The certification basis for the change could be approved in several ways:

(a) If the FAA determines that no later regulation is to be applied, the applicant would demonstrate compliance with the existing certification basis, and there would be no administrative or compliance costs associated with application of this changed products rule.

(b) If the FAA determines that a later regulation is to be applied, the applicant can accept that determination, and, while there would be compliance costs associated with accepting the FAA determination, there would be no administrative costs.

(c) If the FAA determines that a later regulation is to be applied, the applicant could submit a technical analysis to demonstrate that, for example, compliance with the later regulation would be impractical or would not contribute materially to the level of safety of the product. In that case---

(1) If the FAA agrees with the applicant's technical analysis, the applicant would demonstrate compliance with the existing certification basis, and, while there would be no compliance costs, there would be administrative costs.

(2) If the FAA does not agree with the applicant's technical analysis, the applicant would demonstrate compliance with the later regulation, and there would be resultant administrative and compliance costs.

Thus, in practice, the total costs to applicants for changes to the smaller aircraft could be a combination of "no costs" (scenario "(a)" above), compliance costs only (scenario "(b)" above), administrative costs only (scenario "(c)(1)" above), and compliance and administrative costs (scenario "(c)(2)" above). The calculations in this regulatory analysis are based on the assumption that, if the FAA determines that a later regulation should apply, the applicant will demonstrate compliance with the later regulation, and will not attempt to demonstrate that one of the exceptions in § 21.101 applies, e.g., that compliance with the later regulation would be impractical or would not contribute materially to the level of safety.

However, one needs to consider the following. The applicant will make their own educated determination as to the applicability of the later regulation, and will decide to accept compliance with that regulation only when they are relatively certain that the administrative costs

of demonstrating that one of the § 21.101 exceptions applies and will exceed the costs of demonstrating compliance with the later regulation. Thus, this regulatory analysis somewhat over-estimates total compliance costs in that it assumes that applicants will always forego their opportunities to convince the FAA that compliance with the later regulation would be impractical or would not contribute materially to the level of safety. By the same token, that assumption results, somewhat, in an under-estimation of the total administrative costs.

Only when an applicant has decided that compliance costs are likely to actually exceed administrative costs, will the applicant choose to expend the resources to make the "impracticality," "contribution to safety," or other arguments. Furthermore, an applicant is more likely to choose to make those arguments when there is a persuasive technical foundation for them. Therefore, this regulatory analysis over-estimates compliance costs by including those costs that would tend to be avoided by the more efficient expenditure of administrative resources. And, by the same token, the administrative costs that are "unaccounted for" due to the above under-estimation are more likely to be spent in realistic efforts to avoid even higher compliance costs. The net effect is that this regulatory evaluation over-estimates total costs.

### **Regulatory Flexibility Analysis**

The Regulatory Flexibility Act of 1980 (5 U.S.C. 601-612) establishes, "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation." To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the determination finds that it will, the agency must prepare a regulatory flexibility analysis (RFA) as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 act provides that the head of the agency may so certify, and an RFA is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

Recently, the Office of Advocacy of the Small Business Administration (SBA) published new guidance for Federal agencies responding to the requirements of the Small Business Regulatory Enforcement Act of 1996. Following the SBA guidance, the FAA conducted the required review of this rule and determined that, based on the cost assumptions described above, it will have a significant impact on a substantial number of small entities. Accordingly, a full regulatory flexibility analysis was conducted and is summarized as follows.

#### *1. A description of the reasons why action by the agency is being considered.*

In recent years, a trend has developed toward fewer products that are of completely new designs, which would require new type certificates. Over a period of time, a series of changes to an original product may have been made so that the current model is considerably different from the original model. Although each changed product in such a series of changes may differ little from its immediate predecessor, the collective changes can result in a product with substantial differences from the original product.

Another trend in manufacturing is to keep products in production over several decades. Some currently manufactured airplanes have evolved from airplane models originally type-certificated 25 years ago. This does not imply that those airplanes are unsafe, because they do, in practice, have features that address the intent of most of the current airworthiness standards. However, current procedural regulations (part 21) do not require that changed products demonstrate compliance with all current airworthiness standards.

The FAA maintains that the issue should not be whether a product is produced under a new type certificate or an amended one, or changed under a supplemental type certificate. Nor should the certification basis of a changed product turn on the fact that the product is to be modified or initially operated by a small (as opposed to a large) entity. The issue is whether or not the level of safety of the product, embodied in the airworthiness standards it complies with, is as high as practical.

*2. A succinct statement of the objectives of, and legal basis for, the proposed rule.*

The objective of this rule is to enhance safety by applying the latest airworthiness standards, to the greatest extent practical, for the certification of significant design changes to aircraft, aircraft engines, and propellers.

The legal basis for the rule derives from Title 49, U.S.C. § 44701 which authorizes the FAA Administrator to promote safety of flight of civil aircraft in air commerce by prescribing, in part, minimum standards governing the design and construction of aircraft, aircraft engines, and propellers, as may be required in the interest of safety. Under 49 U.S.C. § 44704, the FAA may issue type certificates, including supplemental type certificates, for aircraft, aircraft engines, and propellers.

*3. A description of the projected reporting, recordkeeping and other compliance requirements of the proposed rule, including an estimate of the classes or types of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record.*

As detailed previously in the regulatory evaluation, the requirements imposed by this rule will affect future applicants for amended and supplemental type certificates for changed aeronautical products. The rule will impose both administrative requirements (with certain exceptions) and compliance requirements. It will require applicants to comply with the regulations in effect on the date of the application for the change, as compared to the latest certification basis of the product to be changed, unless one of several conditions is met. Compliance with the later set of regulations will not be required: (1) if the change is not significant, (2) for those areas or components not affected by the change, (3) if such compliance would not contribute materially to the level of safety of the changed product, or (4) if such compliance would be impractical; i.e., would result in costs that would not be commensurate with the safety benefit that would be derived.

Applicants for changes to most products would need to evaluate and demonstrate to the FAA the applicability of these four conditions to their product changes, if compliance to regulations other than the most current is to be required. The skill level necessary to make these determinations will vary widely with the scale and engineering complexity of the individual product change involved. In general, these skills would include a working knowledge of the pertinent aviation regulations, the ability to evaluate and approve technical data, and a combination of training and responsible experience in the field or fields of engineering pertinent to the product change. In assessing the administrative costs of this rule, the regulatory evaluation assumes a fully burdened labor rate of \$105 per hour for the highest skill level necessary to make and support the determinations called for under the rule.

4. *An identification, to the extent practicable, of all relevant federal rules that may duplicate, overlap, or conflict with the rule.*

The FAA is unaware of any federal rules that would duplicate, overlap, or conflict with the final rule.

5. *A description and an estimate of the number of small entities to which the rule will apply.*

This rule will apply to future applicants for amended and supplemental type certificates for changed aeronautical products. FAA regulations are typically directed toward some closely identified industry or occupation; such as domestic air carriers or private pilots. By comparison, the applicants under this rule are not uniquely defined, and may be found in a wide variety of industries. In assessing this rule, the FAA identified 63 industry groups in 19 different four-digit standard industrial classifications (SIC) that would reasonably include applicants for certifications to changed aeronautical products. These industries are listed as Table 9 of the appendix to the full regulatory evaluation.

The Small Business Administration (SBA) provides descriptive national data for the year 1995 on U.S. firms, aggregated at the four-digit SIC level. These data include the numbers of firms, numbers of establishments, employment, annual payroll, and estimated receipts by employment size of firm. Information for the 19 industry classifications identified under this rule were combined to produce the following distributions.

<b>NUMBER OF EMPLOYEES</b>	<b>PERCENT OF FIRMS</b>	<b>ANNUAL RECEIPTS PER EMPLOYEE (\$1000's)</b>
1 - 99	83.2%	148.0
100 - 499	8.0%	163.9
500 OR MORE	8.8%	207.6
<b>TOTAL</b>	<b>100.0%</b>	<b>AVG: 200.1</b>

The SBA also provides small business size standards for each industry. The 19 industry groups that could include firms affected under this rule fall into four separate SBA standards for small business definition: 500, 750, 1000, or 1500 employees. As part of the evaluation for this rule, the FAA analyzed the employment size of firms for a random sample of 227 supplemental and amended type certification projects. The size distribution of these samples is presented below.



NUMBER OF EMPLOYEES	PERCENT OF SAMPLES	CUMULATIVE PERCENT OF SAMPLES
1 -100	44.1%	44.1%
101 - 500	12.3%	56.4%
501 - 750	2.6%	59.0%
751 - 1000	1.8%	60.8%
1001 - 1500	1.3%	62.1%
1501 OR MORE	37.9%	100.0%
<b>TOTAL</b>	<b>100.0%</b>	

As presented in the table, depending on which size standard is applied, between 56.4 percent to 62.1 percent of the changed-product applications that would be affected by this rule will be submitted by small businesses. To simplify discussion, the remainder of this analysis is based on the 62.1 percent proportion and uses the under 1500-employee size standard. As estimated in the full regulatory evaluation, the FAA expects the administrative equivalent of 2,557 applications will be submitted each year, and 1,588 of those would be from small firms.

The final rule, unlike the original rule, includes an administrative exception for applications related to certain small aircraft. Based on the sample of projects that were analyzed for this rule, 16.7 percent of all applications would fall under this exception, and 97.4 percent of the excepted applications would be submitted by small firms. An estimated 417 of the total annual 1,588 small-business applications would qualify for this exception, and the remaining 1,171 would not.

In addition to the administrative requirements for applications that are submitted, the rule will also invoke certain regulatory compliance requirements for the proportion of applications that are completed and certificated. Some 1,649 of the total applications are completed annually as amended or supplemental type certificates and would be subject to the rule's compliance provisions. Of these, an estimated 1,024 will be from small firms.

#### Regulatory Flexibility Cost Analysis

The full regulatory evaluation forecasted costs over a 20-year period, beginning in the year 2000, and assumed a three-percent annual increase in applications. For all applicants, the first year administrative costs of the rule are projected to equal \$1,975,530 (1998 present value \$1,725,504). Using the 1500-employee size standard, small firms are projected to incur 56.6 percent of those costs, equaling \$1,118,679 with a 1998 present value of \$977,098. The small business proportion of expected administrative costs (56.6 percent) is lower than the proportion of applications expected from small business (62.1 percent) because a significantly higher proportion of the administrative exceptions under the rule are projected for small business applicants. This disproportionate exception rate also causes the average increased administrative cost per small business application (\$664)<sup>1</sup> to be smaller than the average for all applicants

<sup>1</sup> Note that these are average costs per application, not per affected application. Based on the sample, 36 percent of all small business applications would meet the "small aircraft" exception under the rule and incur no incremental administrative costs.

(\$728.) For the 20-year study period, incremental small business administrative costs under the rule are projected to total \$30,059,321 with a 1998 present value of \$13,938,179.

The regulatory evaluation also details the incremental costs expected under the rule for compliance with later regulations. Based on the evaluation of sample applications, 48 percent of the future certifications from small business firms would be required to meet some measure of additional later regulations. This proportion is higher than the parallel figure of 41 per cent for applications from all firms.<sup>2</sup> In turn, this higher incidence rate also produces higher small business costs per certification action *if* it is assumed that the scale and complexity of small business and large business certification projects are the same. In the absence of reliable project size estimates, the regulatory evaluation has employed a uniform \$100,000 project size as a unit factor to facilitate decision-making. However, the FAA does not believe that the projects submitted by small and large businesses are typically equal in scale and complexity.

While this analysis uses a compliance cost of \$100,000 for a single project, the FAA believes there is a wide range of compliance costs. For example:

1. A \$100 thousand dollar project. An emergency medical service system for a helicopter over 3,000 pounds. This modification includes a litter/restraint system, medical equipment (oxygen, ventilator, air pump, defibrillator, etc.), and an auxiliary electrical system.
2. A \$20 to \$50 thousand dollar project. An improved stainless steel exhaust system for a twin-engine general aviation aircraft.
3. A \$15 thousand dollar project. The purchase and installation of an avionics instrument system.

For a simple sensitivity test, the compliance cost estimate is directly related to changes in the assumed \$100,000 compliance cost per project. If, for example, the project cost for small business is better represented by \$20,000, then the compliance cost estimates should be reduced by 80 percent.

With the above sensitivity test in mind and using the \$100,000 project size cost, small business applications are expected to incur a year 2000 compliance cost of \$3,582,317 (with a 1998 present value of \$3,128,934.)<sup>3</sup> This represents an average increase of \$3,198 per project, *assuming a unit \$100,000 base project size.*<sup>4</sup> Over the twenty-year study period, small business compliance costs under this scenario are projected to total \$96,006,280 (with a 1998 present value of \$44,532,108.)

#### Affordability Analysis

If the assumed \$100,000 unit of project size is also assumed to be the average size for a small-business project, the increased administrative cost per project (\$664) can be added to the increased compliance cost per project (\$3,198) to provide an expected *average* increase of \$3,862 per project. The relative effect of these costs per small firm is a function of: (1) the size (receipts)

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<sup>2</sup> Note that the "small aircraft" exception under the rule will not alter compliance decisions nor alleviate their costs.

<sup>3</sup> For computational simplicity, the regulatory evaluation overstates initial annual compliance costs by assuming that all such costs would occur in the year that the project is approved. In reality, they would occur over several years.

<sup>4</sup> Aircraft operators or modifiers typically do not amortize the incremental cost of \$3,200 for a modification totaling \$100,000 or more.

of that firm, and (2) the number of project applications that a firm submits/completes per year.<sup>5</sup> The following table presents the average impact of the rule as a percentage of a firm's annual receipts, for various assumptions on firm size and annual number of projects. For example, a firm with 5 projects per year would incur additional costs of 5 times \$3,862; or \$19,310 for the year. If that firm employs 10 people, with each employee producing an average \$148,000 of receipts per year (from the "annual receipts per employee" factors reported above in paragraph 5) the firm's total receipts would equal \$1.48 million. For this example combination of employees and projects, the \$19,310 one-year impact of the rule would equal 1.30 percent of the \$1.48 million estimated annual receipts of the firm. As a matter of context, it should be noted that FAA analysis of the ACOS data shows that 52 percent of applications were submitted by firms that only submitted one application in that year.

**AVERAGE IMPACT OF RULE AS A PERCENTAGE OF ANNUAL RECEIPTS**

EMPLOYEES	ANNUAL NO. OF PROJECTS		
	1	5	10
10	0.26%	1.30%	2.61%
100	0.02%	0.12%	0.24%
1000	0.00%	0.01%	0.02%

Disproportionality Analysis

As discussed in the cost and affordability analyses above, a higher proportion of total certification applications is received from small businesses (62.1 percent) than from large businesses (37.9 percent). This is not surprising given the relative proportions of numbers of small and large businesses. By comparison, the small business proportion of expected administrative costs (56.6 percent) will be lower than the proportion of applications expected from small businesses (62.1 percent) because a significantly higher proportion of the administrative exceptions under the rule are projected for small business applicants. By comparison, the sample survey assessment predicts that small business applicants will disproportionately incur the additional costs of complying with later regulations as a result of the rule. The sample survey predicts that the rule will require 48 percent of small business applications, as compared to 29 percent of large business applications, to comply with later regulations.

Competitiveness Analysis

As discussed above, it appears that there will be proportionally higher compliance costs imposed by the rule on small than on large businesses. This information is not sufficient, however, to determine the impact of the competitiveness of small business vis-à-vis large entities. There is a wide divergence in the characteristics and ultimate consumer of products. There is a fundamental difference among large, fixed-wing commercial aviation, general aviation, and rotorcraft. Also, the products that are produced by the companies that are subject to the rule are not homogeneous. The wide range of products that would be certificated under this rule includes

<sup>5</sup> FAA analysis of the ACOS data shows that 52% of applications were submitted by firms that only submitted one application in that year.

major aircraft components such as wings, diversely unique avionics, and small subassemblies such as seat fasteners. Also, many of the larger companies in this field are assemblers of products that often are produced by small companies. As such, the large companies may be customers rather than competitors to the affected small companies.

#### Business Closure Analysis

The FAA believes that the average impact of the rule gauged by the cost of the rule per year relative to an affected firm's average annual receipts is likely to be low. In cases where the potential costs would be prohibitive, firms may decide not to proceed with the intended change. This would prevent cash flow problems, losses, and business closure in the short run. However, a series of decisions not to certify new products could affect long run business viability. Based on the sample of 250 applications analyzed by the FAA, the agency believes that the vast majority of applications would not impose high enough compliance costs to threaten business closure of small business.

#### Description of Alternatives

Three primary alternatives were considered in crafting this rule. The first would be to take no new rulemaking action and to retain the changed-product certification process as it now exists. The FAA opposes this alternative because it would not address the problem whereby a series of cumulative changes can result in a model that is substantially different from the original model, yet that product is not required to demonstrate compliance with all the recent airworthiness standards.

The second evident alternative would be to retain the existing certification process for changes to small aircraft, since the bulk of these applications are submitted by small firms. Again, the FAA opposes this alternative since it would leave the existing problem for a segment of the industry and would create an unacceptable inequity across aircraft model sizes.

As an alternative to full exclusion from the rule, the FAA has included a small-aircraft exception for the administrative responsibilities of the final rule, but not for its compliance provisions. This exception was specifically added to address small business concerns that arose from the proposed rule. The exception will apply to applicants for changes to either: (1) non-turbine rotorcraft of 3,000 pounds or less maximum weight, or (2) other aircraft of 6,000 pounds or less. For changes to such products, the FAA (i.e., the Aircraft Certification Office (ACO) processing the application) may make an initial determination that one or more later airworthiness standards should be part of the certification basis of the changed product. If the ACO makes that determination, the applicant may submit technical analyses to convince the ACO that compliance with the later regulation(s) would be impractical or would not contribute materially to the level of safety of the product. However, as discussed previously in this summary, the regulatory analysis makes the conservative assumption that the applicant will forego the administrative costs of those technical analyses and incur the compliance costs (estimated to be twice that of administrative costs) attributable to the later regulation(s).

Based on the sample survey, 16.7 percent of all project applications would qualify for this exception, and 97.4 percent of the excepted applications would come from small firms (fewer than 1500 employees). In point of fact, 81.6 percent of the exceptions would go to firms with less than 100 employees.

The value of applicant costs that will be averted by the small-aircraft exception is detailed in the full regulatory evaluation. The expected value of all exceptions in the first year of the rule (year 2000) is calculated at \$457,224. Over the 20-year study period, the value of exceptions totals to \$12.3 million with a 1998 present value of \$5.7 million. Again, over 97 percent of this

relief will go to small businesses. The small-aircraft exception provision is predicted to reduce the rule's administrative burden on small businesses by 27.6 percent from the level that would exist without it. The total small business cost burden (administrative and compliance costs) will be 6 percent lower as a result of this exception.

Other alternatives were considered, but were determined not to be practicable. These included (1) requiring applicants for changes to comply with the latest regulations, with no exceptions; and (2) requiring a complete recertification at certain intervals (10 years).

#### Compliance Assistance

The FAA will issue an advisory circular based on this rulemaking. The circular will provide examples and guidance for determining the certification basis of changed aeronautical products. Small businesses and other applicants may follow this guidance in developing their own arguments as to the appropriate certification basis of their changed products. The circular will be available from the FAA's aircraft certification offices and through the FAA website.

The agency intends to use a variety of additional mechanisms to inform applicants and industry trade associations of the rule change and to explain the new procedures. The FAA will serve copies of this final rule document, with the Regulatory Evaluation Summary, on trade associations that represent most of the small entities affected by this rule. The FAA also will utilize its directorate newsletters to inform industry. The agency will present information on the new rule at industry and FAA designee meetings. In addition, a training video and instructional materials are being developed that will introduce the new rule and explain the respective roles of applicants and FAA personnel. These products will also be available to small businesses through the aircraft certification offices.

#### **International Trade Impact Assessment**

The provisions of this rule promotes international trade for U.S. firms doing business in foreign countries and foreign firms doing business in the United States. The final rule results, primarily, from a recommendation harmonized with the aviation authorities of Canada and Europe. Transport Canada and the Joint Aviation Authorities have proposed similar corresponding changes to regulations governing type certification procedures for changed products.

The Trade Agreements Act (19 U.S.C. 2531-2533) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the U.S. This final rule imposes additional safety requirements for aviation products that are registered in the U.S. Thus, this final rule does not create any unnecessary obstacles to the foreign commerce of the U.S.

#### **Unfunded Mandates Reform Act**

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), codified as 2 U.S.C. §§ 1501-1571, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in expenditures by State, local, and tribal governments, in the aggregate, or by the private sector of \$100 million or more (adjusted annually for inflation) in any one year.

This rule does not meet the thresholds of the Act. Therefore, the requirements of Title II of the Act do not apply.

#### **Executive Order 13132, Federalism.**

The FAA has analyzed this proposed rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action would not have a substantial direct

effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, we determined that this notice does not have federalism implications.

### **Environmental Analysis**

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental assessment or environmental impact statement. In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this rulemaking action qualifies for a categorical exclusion.

### **Energy Impact**

The energy impact of the rule has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) Pub. L. 94-163, as amended (42 U.S.C. 6362). It has been determined that it is not a major regulatory action under the provisions of the EPCA.

### **List of Subjects**

#### 14 CFR Part 11

Administrative practices and procedures reporting

#### 14 CFR Part 21

Aircraft, Aviation safety, Safety, Type certification

#### 14 CFR Part 25

Aircraft, Aviation safety, Safety, Type certification

### **Adoption of Amendments**

Accordingly, the FAA amends parts 11, 21, and 25, Chapter 1 of Title 14, Code of Federal Regulations, as follows:

### **PART 11--GENERAL RULEMAKING PROCEDURES**

1. The authority citation for part 11 continues to read as follows:

**Authority:** 49 U.S.C. 106(g), 40101, 40103, 40105, 40109, 40113, 44110, 44502, 44701-44702, 44711, 46102.

2. Section 11.11 is amended by removing the first sentence and adding two sentences, in its place, to read as follows:

#### **§ 11.11 Docket.**

Official FAA records relating to rulemaking actions are maintained in current docket form in the Office of the Chief Counsel. These records include: Proposals, notices of proposed rulemaking, written material received in response to notices, petitions for rulemaking and exemptions, written material received in response to summaries of petitions for rulemaking and exemptions, petitions for rehearing or reconsideration, petitions for modification or revocation, notices denying petitions for rulemaking, notices granting or denying exemptions, summaries required to be published under § 11.27, special conditions required as prescribed under §§ 21.16 or 21.101(d) of this chapter, written material received in response to published special conditions, reports of proceedings conducted under § 11.47, notices denying proposals, and final rules or orders. \* \* \*

**PART 21--CERTIFICATION PROCEDURES FOR PRODUCTS AND PARTS**

3. The authority citation for part 21 continues to read as follows:

**Authority:** 42 U.S.C. 7572; 49 U.S.C. 106(g), 40105, 40113, 44701-44702, 44707, 44709, 44711, 44713, 44715, 45303.

4. Section 21.19 is revised to read as follows:

**§ 21.19 Changes requiring a new type certificate.**

Each person who proposes to change a product must apply for a new type certificate if the Administrator finds that the proposed change in design, power, thrust, or weight is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

5. Section 21.101 is revised to read as follows:

**§ 21.101 Designation of applicable regulations.**

(a) An applicant for a change to a type certificate must show that the changed product complies with the airworthiness requirements applicable to the category of the product in effect on the date of the application for the change and with parts 34 and 36 of this chapter. Exceptions are detailed in paragraphs (b) and (c) of this section.

(b) If paragraphs (b)(1), (2), or (3) of this section apply, an applicant may show that the changed product complies with an earlier amendment of a regulation required by paragraph (a) of this section, and of any other regulation the Administrator finds is directly related. However, the earlier amended regulation may not precede either the corresponding regulation incorporated by reference in the type certificate, or any regulation in §§ 23.2, 25.2, 27.2, or 29.2 of this chapter that is related to the change. The applicant may show compliance with an earlier amendment of a regulation for any of the following:

(1) A change that the Administrator finds not to be significant. In determining whether a specific change is significant, the Administrator considers the change in context with all previous relevant design changes and all related revisions to the applicable regulations incorporated in the type certificate for the product. Changes that meet one of the following criteria are automatically considered significant:

- (i) The general configuration or the principles of construction are not retained.
- (ii) The assumptions used for certification of the product to be changed do not remain valid.

(2) Each area, system, component, equipment, or appliance that the Administrator finds is not affected by the change.

(3) Each area, system, component, equipment, or appliance that is affected by the change, for which the Administrator finds that compliance with a regulation described in paragraph (a) of this section would not contribute materially to the level of safety of the changed product or would be impractical.

(c) An applicant for a change to an aircraft (other than a rotorcraft) of 6,000 pounds or less maximum weight, or to a non-turbine rotorcraft of 3,000 pounds or less maximum weight may show that the changed product complies with the regulations incorporated by reference in the type certificate. However, if the Administrator finds that the change is significant in an area, the Administrator may designate compliance with an amendment to the regulation incorporated by reference in the type certificate that applies to the change and any regulation that the

Administrator finds is directly related, unless the Administrator also finds that compliance with that amendment or regulation would not contribute materially to the level of safety of the changed product or would be impractical.

(d) If the Administrator finds that the regulations in effect on the date of the application for the change do not provide adequate standards with respect to the proposed change because of a novel or unusual design feature, the applicant must also comply with special conditions, and amendments to those special conditions, prescribed under the provisions of § 21.16, to provide a level of safety equal to that established by the regulations in effect on the date of the application for the change.

(e) An application for a change to a type certificate for a transport category aircraft is effective for 5 years, and an application for a change to any other type certificate is effective for 3 years. If the change has not been approved, or if it is clear that it will not be approved under the time limit established under this paragraph, the applicant may do either of the following:

(1) File a new application for a change to the type certificate and comply with all the provisions of paragraph (a) of this section applicable to an original application for a change.

(2) File for an extension of the original application and comply with the provisions of paragraph (a) of this section. The applicant must then select a new application date. The new application date may not precede the date the change is approved by more than the time period established under this paragraph (e).

(f) For aircraft certificated under §§ 21.17(b), 21.24, 21.25, and 21.27 the airworthiness requirements applicable to the category of the product in effect on the date of the application for the change include each airworthiness requirement that the Administrator finds to be appropriate for the type certification of the aircraft in accordance with those sections.

6. Section 21.115 is amended by revising paragraph (a) to read as follows:

**§ 21.115 Applicable requirements.**

(a) Each applicant for a supplemental type certificate must show that the altered product meets applicable requirements specified in § 21.101 and, in the case of an acoustical change described in § 21.93(b), show compliance with the applicable noise requirements of part 36 of this chapter and, in the case of an emissions change described in § 21.93(c), show compliance with the applicable fuel venting and exhaust emissions requirements of part 34 of this chapter.

\* \* \* \* \*

**PART 25--AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES**

7. The authority citation for part 25 continues to read as follows:

**Authority:** 49 U.S.C. 106(g), 40113, 44701-44702, 44704.

8. Section 25.2 is amended by revising paragraph (c) to read as follows:

**§ 25.2 Special retroactive requirements.**

\* \* \* \* \*

(c) Compliance with subsequent revisions to the sections specified in paragraph (a) or (b) above of this section may be elected or may be required in accordance with § 21.101(a) of this chapter.

Issued in Washington, DC, on May 31, 2000.

/s/

Jane F. Garvey,  
Administrator.



## **Appendix D**

### **Revised Rules: 21.19, 21.101, 21.115, 25.2**

#### **14 CFR 21.19 Changes requiring a new type certificate.**

Each person who proposes to change a product must apply for a new type certificate if the Administrator finds that the proposed change in design, power, thrust, or weight is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

#### **14 CFR 21.101 Designation of applicable regulations.**

(a) An applicant for a change to a type certificate must show that the changed product complies with the airworthiness requirements applicable to the category of the product in effect on the date of the application for the change and with parts 34 and 36 of this chapter. Exceptions are detailed in paragraphs (b) and (c) of this section.

(b) If paragraphs (b)(1), (2), or (3) of this section apply, an applicant may show that the changed product complies with an earlier amendment of a regulation required by paragraph (a) of this section, and of any other regulation the Administrator finds is directly related. However, the earlier amended regulation may not precede either the corresponding regulation incorporated by reference in the type certificate, or any regulation in §§23.2, 25.2, 27.2, or 29.2 of this chapter that is related to the change. The applicant may show compliance with an earlier amendment of a regulation for any of the following:

(1) A change that the Administrator finds not to be significant. In determining whether a specific change is significant, the Administrator considers the change in context with all previous relevant design changes and all related revisions to the applicable regulations incorporated in the type certificate for the product. Changes that meet one of the following criteria are automatically considered significant:

- (i) The general configuration or the principles of construction are not retained.
  - (ii) The assumptions used for certification of the product to be changed do not remain valid.
- (2) Each area, system, component, equipment, or appliance that the Administrator finds is not affected by the change.
- (3) Each area, system, component, equipment, or appliance that is affected by the change, for which the Administrator finds that compliance with a regulation described in paragraph (a) of this section would not contribute materially to the level of safety of the changed product or would be impractical.

(c) An applicant for a change to an aircraft (other than a rotorcraft) of 6,000 pounds or less maximum weight, or to a non-turbine rotorcraft of 3,000 pounds or less maximum weight may show that the changed product complies with the regulations incorporated by reference in the type certificate. However, if the Administrator finds that the change is

significant in an area, the Administrator may designate compliance with an amendment to the regulation incorporated by reference in the type certificate that applies to the change and any regulation that the Administrator finds is directly related, unless the Administrator also finds that compliance with that amendment or regulation would not contribute materially to the level of safety of the changed product or would be impractical.

(d) If the Administrator finds that the regulations in effect on the date of the application for the change do not provide adequate standards with respect to the proposed change because of a novel or unusual design feature, the applicant must also comply with special conditions, and amendments to those special conditions, prescribed under the provisions of §21.16, to provide a level of safety equal to that established by the regulations in effect on the date of the application for the change.

(e) An application for a change to a type certificate for a transport category aircraft is effective for 5 years, and an application for a change to any other type certificate is effective for 3 years. If the change has not been approved, or if it is clear that it will not be approved under the time limit established under this paragraph, the applicant may do either of the following:

(1) File a new application for a change to the type certificate and comply with all the provisions of paragraph (a) of this section applicable to an original application for a change.

(2) File for an extension of the original application and comply with the provisions of paragraph (a) of this section. The applicant must then select a new application date. The new application date may not precede the date the change is approved by more than the time period established under this paragraph (e).

(f) For aircraft certificated under §§21.17(b), 21.24, 21.25, and 21.27 the airworthiness requirements applicable to the category of the product in effect on the date of the application for the change include each airworthiness requirement that the Administrator finds to be appropriate for the type certification of the aircraft in accordance with those sections.

## **14 CFR 21.115 Applicable requirements.**

(a) Each applicant for a supplemental type certificate must show that the altered product meets applicable requirements specified in §21.101 and, in the case of an acoustical change described in §21.93(b), show compliance with the applicable noise requirements of part 36 of this chapter and, in the case of an emissions change described in §21.93(c), show compliance with the applicable fuel venting and exhaust emissions requirements of part 34 of this chapter.

**PART 25--AIRWORTHINESS STANDARDS: TRANSPORT  
CATEGORY AIRPLANES**

**14 CFR 25.2 Special retroactive requirements.**

\* \* \* \* \*

(c) Compliance with subsequent revisions to the sections specified in paragraph (a) or (b) of this section may be elected or may be required in accordance with §21.101(a) of this chapter.



**Appendix E**  
**Order 8110.XX**

The CPR Order begins on the next page.

This is NOT the signed, final version. This is *DRAFT* version 4/21/2003.



4/21/03

**SUBJ: HOW TO ESTABLISH THE CERTIFICATION BASIS FOR CHANGED  
AERONAUTICAL PRODUCTS**

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**1. Purpose.** This order revises the procedures for determining the certification basis for changes to type certificated products, reflecting amendments to Title 14 of the Code of Federal Regulations (14 CFR) §§ 21.19, 21.101, and 21.115. These procedures apply to design changes made through an amended Type Certificate (TC), a Supplemental Type Certificate (STC), or an amended STC. These procedures also apply to type validation programs. Under this order, Aircraft Certification Service personnel must apply these revised procedures to determine the certification basis for changed products.

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**Distribution:**

A-W(IR)-3; A-W(FS)-2; A-X(CD)-2; A-FFS-10(ALL); AEU-100, A-FAC-O-(ALL);  
AFS-600 (3 copies)

**Initiated By:** AIR-110

**2. Distribution.** This order is distributed to the Washington headquarters branch level in the Aircraft Certification Service; to the Washington headquarters division levels of Flight Standards Service; to all Chief Scientists and Technical Advisors (CSTAs); to all Aircraft Certification Directorates; to all Aircraft Certification Offices; to all Manufacturing Inspection Offices (MIO); to the International Airworthiness Programs Staff; to all Aircraft Evaluation Groups (AEG); to all Manufacturing Inspection District and Satellite Offices (MIDO and MISO); to the Brussels Aircraft Certification; and to the Regulatory Support Division.

**3. Division Related Publications.**

- a. Order 8110.4B, Type Certification.
- b. Order 8100.5, Aircraft Certification Directorate Procedures.
- c. Advisory Circular (AC) 21.101-1, Change 1, Establishing the Certification Basis of Changed Aeronautical Products.

**4. Effective Date.** This order explains how to implement type certification procedures for changed products per 14 CFR part 11 amendment 45, part 21 amendment 77, and part 25 amendment 99. For details on these amendments, refer to the June 7, 2000, final rule published in the *Federal Register* [65 FR 36244]. The changes to 14 CFR part 21 and the procedures in this order apply to all products starting June 10, 2003.

**5. Background on Previous Certification Procedures.**

a. Section 44701 of Title 49 of the U.S. Code (U.S.C.) requires the Administrator to promote safe flight of civil aircraft in air commerce by prescribing minimum standards in the interest of safety for the design, material, construction, quality of work, and performance of aircraft, aircraft engines, propellers, and appliances. Under 49 U.S.C. § 44704 the Administrator can issue TCs and STCs for aircraft, aircraft engines, and propellers.

b. The general certification procedures for products (aircraft, aircraft engines, and propellers) and parts are in 14 CFR part 21. Title 14 CFR §§ 21.16 through 21.29, 21.101, and 21.115 specify certain regulations and the applicable airworthiness standards for type certification of new and changed products. The term “changed product” – used throughout part 21 and this order – includes changes that are made through an amended TC, an STC, or amended STC.

c. Previous 14 CFR § 21.101(a) required that an applicant for a change to a TC comply with either the regulations cited in the TC or applicable regulations in effect on the date of application, plus any other amendments the Administrator found to be directly related. If an applicant chose to show compliance with the regulations in effect on the date of the application for the change, the applicant was also required to comply with any other directly related regulations. In some instances, a regulation may have been amended to become less stringent, while a related regulation had become more stringent. In these situations, an applicant was also required to comply with the related, more stringent regulation.

d. Since the previous 14 CFR § 21.101(a) did not require applicants to comply with the latest amendments to the regulations and did not grant the Administrator the authority to require them to comply with the latest amendments to increase product safety, an applicant for a change to a

type certificated product could show only that the altered product complied with the existing certification basis.

e. Previous 14 CFR § 21.101(b) dealt with changes for which the regulations did not provide adequate standards. Such changes generally consisted of a new design or a substantially complete redesign of a component, equipment, or system installation, and sometimes involved features that were not foreseen when the regulations were adopted. For these novel or unusual changes, the applicant was required to comply with regulations that provided a level of safety equal to that established in the original certification basis.

**6. Revised Certification Procedures.** The revised certification procedures promote the continuous introduction of new airworthiness standards for changed products.

a. Designation of applicable regulations (14 CFR §§ 21.101) applies to changes in the type design of aircraft, aircraft engines, and propellers, which do not require a new TC under 14 CFR § 21.19. This procedure enhances safety by applying the latest airworthiness standards, to the greatest extent practical, for certifying significant design changes.

b. For validation programs, the validating authority's date of application is the date the applicant applied to the certifying authority for the design change. Applicants should consult individual Bilateral Aviation Safety Agreement Implementation Procedures for Airworthiness (BASA IPA) when developing the validation basis for an amended TC, STC, or amended STC program.

c. Under 14 CFR § 21.101(a), a change to a type certificated product must comply with the latest requirements, unless it complies with the exceptions in 14 CFR §§ 21.101(b) and (c). The certification basis does not depend on whether the TC holder or an applicant for a STC is originating the change.

d. Title 14 CFR § 21.101(b) describes criteria for when an applicant can use earlier requirements. Applicants may use earlier requirements when the change is not significant. In cases where design changes involve features that have no adequate regulatory standard in the existing certification basis – but later appropriate regulations exist – the Administrator requires that applicants use appropriate later regulations for the proposed design change. For not significant design changes, the rule allows continued compliance with the existing certification basis, unless there is no adequate regulatory standard in the existing certification basis, without further approval by the Administrator.

e. Title 14 CFR §§ 21.101(b)(1)(i) and (ii) describes the automatic criteria for determining if the change is significant. Under 14 CFR §§ 21.101(b)(2) and (b)(3), applicants may use earlier requirements for significant changes to areas not affected by the change, or for cases where compliance to the latest requirements would not contribute materially to the level of safety or would be impractical. Earlier amendments may not precede the corresponding regulation listed in the existing certification basis or any requirement in 14 CFR §§ 23.2, 25.2, 27.2, or 29.2.

f. Title 14 CFR § 21.101(c) provides an exception to the requirements of 14 CFR § 21.101(a). An applicant for a change to an aircraft (other than rotorcraft) of 6,000 pounds or less maximum weight, or to a non-turbine rotorcraft of 3,000 pounds or less maximum weight, may show that the changed product complies with the regulations listed in the TC. The



applicant may elect to comply with the later regulations. If the Administrator finds that the change is significant in an area of the product, the Administrator may require that the product comply with:

(1) A later amendment to the regulations listed in the type certificate data sheet (TCDS) that applies to the change, and

(2) Any regulation the Administrator finds is directly related.

**NOTE:** See paragraph 9 of the Advisory Circular 21.101-1 Change 1, for specific guidance on this provision.

**g.** Under 14 CFR § 21.101(d), special conditions apply when the regulations do not provide adequate standards for the proposed change because of a novel or unusual design feature. Title 14 CFR § 21.101(d) applies to significant and not significant design changes.

**h.** Title 14 CFR § 21.101(e) explains how long an application remains valid for a change to a TC, including STCs. An application for a change to a TC for a transport category aircraft is effective for five years, and an application for a change to any other category aircraft is effective for three years.

**i.** Title 14 CFR § 21.101(f) describes aircraft certificated under the requirements of 14 CFR §§ 21.17(b), 21.24, 21.25, and 21.27. The airworthiness requirements in effect on the date of application for these aircraft include airworthiness requirements that the Administrator finds to be appropriate.

**7. Roles and Responsibilities.** The following information identifies the roles and responsibilities for both the applicant and Aircraft Certification Service during certification projects:

**a. Applicants:**

(1) Identify and evaluate the proposed change. In assessing the change, define the affected areas and include previous relevant design changes along with the related, appropriate regulations. The evaluation should be comprehensive enough to fully understand the scope of the change.

(2) Identify if the change is significant or not significant at the product level using the information in AC 21.101-1 change 1. The determination of significance must include a review of any previous relevant design changes.

(3) Apply the latest regulations for significant changes, unless a proposal is presented to apply earlier regulations. The applicant may propose to use one of the exceptions of 14 CFR § 21.101(b)2 or (b)3, that is, not affected area, does not contribute materially to the level of safety, and/or impracticality.

(4) Propose a certification basis with appropriate amendment levels.

**b. Aircraft Certification Service:**

(1) Guides the applicant on how to apply the rule. Each ACO and Directorate standards staff will have a Changed Product Rule focal point to advise on how to apply the rule. Also, the Certification Procedures Branch, AIR-110, has a focal point to support the Directorates regarding issues on the application of 14 CFR § 21.101, and provide leadership to the continuous improvement process.

(2) Uses the certification project notification (CPN) to notify the Directorate standards staff of the application and proposal, including the applicant's position on significance. The CPN will have an additional block to identify a significant change contrasted with a significant project. Appendix 2 references the new CPN form.

(3) Uses the delegation system to streamline implementation. Each ACO must work closely with its applicants to establish an effective delegation system.

(4) Determines if the change is significant for excepted aircraft per 14 CFR § 21.101(c). These products "default" as not significant design changes.

(5) Approves or disapproves the latest amendment exceptions as proposed by the applicant. When the applicant proposes exceptions, the FAA engineer must review data submitted and make a finding. Many times the Administrator will have predetermined if the change is not significant. The table in Appendix 1 of AC 21.101-1, Change 1 contains examples – predetermined by the Administrator – of substantial, significant, and not significant design changes.

(6) Uses the G-1 issue paper to record issues and resolution for changes to the certification basis. The G-1 issue paper would normally be used to document: significant changes where earlier regulations are applied per 21.101(b)(2)(3) (unaffected area, contribution to the level of safety, and impracticality); not significant changes, due to an inadequate certification basis, requiring the use of later regulations; and the application of special conditions per 21.101(d). All disagreements between the applicant and the Directorate regarding application of 14 CFR 21.101 will be resolved by AIR-110, the Certification Procedures Branch.

(7) Determines the certification basis. To establish the certification basis for validation programs, the ACO engineer should consult the procedures in the appropriate BASA IPA.

(8) Documents the certification basis in the amended TC or STC. See appendix 1, Samples of Documenting a Certification Basis for examples of documenting a design change.

**8. Determining the Applicability of CFR § 21.101 for Changed Products.**

**a.** A "change to a type certificate" as stated in 14 CFR § 21.101 refers to changes in type design. Minor changes (as classified by 14 CFR § 21.93 and approved under 14 CFR § 21.95) are by definition considered to be not significant. Therefore, they can be approved per the existing certification basis.

**b.** Substantial changes (14 CFR § 21.19) to a product that are so extensive that they require a complete investigation of compliance require a new TC. The process for determining substantial changes has not changed. The Administrator weighs the magnitude of the proposed design change against the degree of investigation needed to establish compliance with the regulations. New type certificates require the use of the regulations in effect on the date of application for the change. The following table outlines the certification process for substantial and not substantial changes:

<b>If the Administrator finds that the proposed design change ...</b>	<b>Then the applicant must ...</b>	<b>And ...</b>
Is substantial.	Submit an application for a new TC.	Establish the certification basis (14 CFR § 21.17), using the regulations in effect on the date of application for the change.
Is not substantial.	Comply with 14 CFR § 21.101.	Develop the certification basis, per guidance in this order and AC 21.101-1, Change 1.

**c.** Examples of a design change that require a new TC are no longer listed in 14 CFR § 21.19. These design changes are now evaluated case by case.

**d.** Title 14 CFR § 21.101 applies to all changes to type certificated products regardless of approval method: amended TC, STC, or amended STC.

**e.** The certification basis can vary depending on the magnitude and scope of the change. See the tables in appendix 1 of AC 21.101-1, Change 1 for classifications of typical substantial, significant, and not significant design changes. Where the classification is not obvious for the proposed change, follow Paragraph 7 and Figure 1 of AC 21.101-1, Change 1 to determine the appropriate certification basis for the changed product.

**f.** A product level change is a change or combination of changes that makes the product distinct from the existing product (for example, range, payload, speed). Product level change is defined at the aircraft, aircraft engine, or propeller level and would result in an amended TC, STC, or amended STC. These changes typically, but not always, result in a model change that requires an amendment to the TC. However, a model change is not a prerequisite for a product level change. A system or component change can also rise to the product level.

**(1)** The product level change concept is directly related to the determination of significance, that is, the criteria used to determine significance. To assess if a change is significant, the applicant must consider the change and its effect on the overall aircraft, aircraft engine, or propeller at the product level.

**g.** A significant change is a change to the type certificate to the extent that it changes one or more of the following: general configuration, principles of construction, or the assumptions used for certification, but not to the extent to be considered a substantial change. The significance of the change must be considered in the context of all previous relevant design changes and all related revisions to the applicable regulations. Not all changes or product level changes are significant. Title 14 CFR § 21.101(b)(1) defines a significant change based on three automatic criteria:

(1) Significant changes to the general configuration are changes likely to require a new model designation to distinguish the product from other product models, for example, performance or interchangeability of major components.

(2) Significant changes to the principles of construction are changes to the materials and/or construction methods that affect the overall product's operating characteristics or inherent strength. They would require extensive reinvestigation to show compliance. An example is a primary structure change from metal to composites.

(3) Significant changes to the assumptions used for certification are changes to the product level assumptions associated with the compliance demonstration, performance, or operating envelope. These changes are so different that they invalidate the original assumptions. Examples may include:

(a) Changing an aircraft from an unpressurized to pressurized fuselage;

(b) Changing operation of a transport fixed wing airplane from land-based to water-based; and

(c) Operation envelope expansions that are outside the existing design parameters and capabilities. Merely expanding the envelope for which the product was originally designed is generally not a significant change because the assumptions – that is, the methodology or approach – used for certification of the basic product remain valid. The applicant can use the methodology/approach for the changed product with predictable effects.

**h.** Typically a change to a single area, system, or component will not result in a product level change. However there may be distinct cases where the change to a single system or component may, in fact, result in a significant change. For example, most avionics system installations adapt easily and do not change the product's general configuration or principles of construction. However, where a system installation affects the aircraft's operation, performance, or capability, it may, in turn, invalidate the original assumptions used for certification, and therefore result in a significant change under 14 CFR § 21.101(b)(1).

**i.** Previous relevant design changes can trigger one or more of the criteria in 14 CFR §§ 21.101(b)(1)(i) and (ii). When assessing a significant design change, either singularly or collectively, consider the cumulative effect of previous relevant design changes. Applicants may have included these previous design changes through earlier changes in the TC. The collective result may be a product considerably different from the latest updated certification basis for the product or model. Two examples of previous relevant aircraft design changes, which address those incremental increases, are weight or thrust. While individually not

significant (for example, 2 percent, 4 percent, or 5 percent discrete increases), these changes can – through a series of changes – become a significant change as incremental changes are made to the product.

**j.** If a proposed design change, together with any previous relevant design changes, triggers any of the three criteria in 14 CFR §§ 21.101(b)(1)(i) and (ii), the change is significant. Later regulatory amendments by themselves cannot drive the design change to be significant. See AC 21.101-1, Change 1, Paragraphs 6 and 7 for additional guidance on assessing significance.

**k.** The applicant must assess the effects of a significant change on other systems, components, equipment, or appliances of the product because areas that have not been changed may be affected. However, the applicant need not resubstantiate those areas of the product where the change or the updated certification basis will not invalidate the original substantiation. If the significant change does not affect an area, then the applicant need not revisit the certification basis of that area.

**l.** Secondary changes are changes to the affected areas that are part of, and consequential to, the design change. They do not add new capabilities or capacity to the product, and are always required by the significant change to complete the installation. Examples of secondary changes include: extending hydraulic line for landing gear, adding circuit breakers for a comprehensive flight deck upgrade, extending ventilation ducting, lengthening control cables or wiring to accommodate a fuselage plug. Secondary changes are considered not significant and may continue to comply with the existing certification basis.

**m.** The Administrator evaluates a design change on an engine or propeller independently of the aircraft. However, applicants must assess engine or propeller design changes when installed at the aircraft level. They also should establish a separate classification for the product. A significant change at the engine or propeller level may not be significant at the aircraft level or vice versa, and may require dual certification (one for the engine or propeller, and the other for the aircraft).

**n.** The airworthiness requirements in effect on the date of application are in 14 CFR parts 21, 23, 25, 27, 29, 31, 33, and 35. Predecessor regulations – Civil Air Regulations (CARs) – are not recognized under 14 CFR § 21.101(a), but may be allowed under 14 CFR §§ 21.101(b), (c) and (f).

## **9. Certification Basis for Significant Changes.**

**a.** If the Administrator classifies the change as significant, the applicant must comply with the amendments in effect on the date of application for the change. The applicant may use the exceptions in 14 CFR §§ 21.101(b)(2) and (3) to show compliance with earlier amendments or with the existing certification basis. For areas not affected by the change, and areas affected by the change for which compliance with the latest requirements would not contribute materially to the level of safety or would be impractical, the applicant must provide acceptable justification to support the application of the earlier amendments. The final certification basis may combine the latest, earlier, and existing regulations, but not regulations that precede the existing certification

basis. Paragraph 8 and Appendices 2 and 3 of the AC 21.101-1, Change 1 describe exceptions to 14 CFR §§ 21.101(b)(2) and (3).

**b.** Pursuing a change for a specific product may not be economically viable for all applicants. Some applicants cannot afford changes that are deemed practical. Because compliance with the latest regulations may be affordable for a large manufacturer but not a smaller one, the change may appear *practical* for the larger manufacturer, but *impractical* for the smaller one. To avoid creating business inequities, both would be required to comply with the same amendment level of a particular regulation.

**10. Certification Basis for Changes That Are Not Significant.** When the change is determined to be not significant, the rule allows continued compliance with the existing certification basis except in the following cases:

**a.** If the change consists of a new or substantially complete redesign of a component or system and the existing certification basis does not provide adequate standards for the design change – that is, the change includes features that were not foreseen in the existing certification basis. The change must comply with later appropriate regulations. Examples are:

**(1)** Replacing a conventional aluminum constructed flap with an all-composite flap. This change would be considered not significant because it does not change the general configuration, principals of construction, or assumptions used for certification at the product level. If the existing certification basis does not contain appropriate regulations, the applicant would apply later regulations addressing the composite requirements. Starting with the existing certification basis, the Administrator will progress through each later regulation to determine the amendment appropriate for the change.

**NOTE:** However, if the applicant changed the primary structure, for example, the wing, from aluminum to composites, this would be a change in the product level principles of construction, and the product level change would be significant. The appropriate latest regulations for composite materials would apply.

**(2)** Adding an advanced avionics system on an aircraft that did not have lightning protection. Compliance with the regulations for lightning protection would be appropriate for this not significant change.

**b.** Applicants may volunteer to comply with later amendments in the existing certification basis, but should consult the Administrator to ensure they also are complying with any other, directly related regulations. Applicants are not allowed to pick and choose without a full understanding of interrelated regulations.

**11. Special Conditions (Novel or Unusual Design Features).**

**a.** If the Administrator finds that the regulations in effect on the date of application for the change do not provide adequate standards because of novel or unusual design features, special conditions apply. Special conditions can apply to both significant and not significant changes.

b. The intent of applying special conditions remains the same as before, in that it addresses novel and unusual design features that were not considered by the existing certification basis and are not covered in later regulations. The appropriate level of safety for the special conditions should be commensurate with the agreed upon certification basis for the change.

## **12. Certification Basis for Excepted Aircraft (14 CFR § 21.101(c)).**

a. Title 14 CFR § 21.101(c) provides an exception to 14 CFR § 21.101(a) compliance with the latest requirements for aircraft (other than rotorcraft) of 6,000 lbs. or less maximum weight, or to a non-turbine rotorcraft of 3,000 lbs. or less maximum weight. In these cases, the applicant may elect to comply with the existing certification basis. However, the applicant has the option of applying later appropriate regulations. Special classes of aircraft – including gliders, airships, and primary category – are addressed in 14 CFR § 21.101(f), and not in 14 CFR § 21.101(c).

b. If the Administrator finds that the change is significant in an area, the Administrator may require the applicant to comply with a later regulation and any regulation the Administrator finds is directly related. Starting with the existing certification basis, the Administrator will progress through each later regulation to determine the amendment appropriate for the change. However, if an applicant proposes, and the Administrator finds, that complying with the later amendment or regulation would not contribute materially to the level of safety of the changed product or would be impractical, the Administrator may allow the applicant to comply with an earlier amendment appropriate for the proposed design change. The amendment may not be earlier than the existing certification basis.

(1) For a significant change, the Administrator must designate which regulations and their amendments will be required. As part of this process, the Administrator will determine each area, system, component, equipment, or appliance that the change affects. Applicants may propose to comply with an earlier amendment if they can justify that the earlier amendment would not contribute materially to the level of safety or would be impractical.

(2) For a not significant change, the applicant may comply with the existing certification basis or may volunteer, subject to the Administrator's approval, to comply with later regulations or later amendments to the existing certification basis. The Administrator must ensure that the applicant complies with any other regulations directly related or relevant. In some instances, a regulation may be amended to become less stringent, while a related regulation may become more stringent. In these situations, the applicant must comply with the related, more stringent regulations.

### **(3) For a not significant change that lacks an adequate certification basis:**

(a) If the change contains new features (which were not foreseen in the existing certification basis and for which appropriate later regulations exist), the Administrator will designate the applicable airworthiness requirements, starting with the existing certification basis and progressing to the most appropriate later amendment level for the change.

(b) If the change contains a novel or unusual design feature, the Administrator will designate the applicable special conditions appropriate for the change, per 14 CFR § 21.101(d).

(4) The exception for products under 14 CFR § 21.101(c) applies to the aircraft only. Design changes to engines and propellers installed on these excepted aircraft are assessed as separate type certificated products using 14 CFR §§ 21.101(a) and (b).

### **13. Certification Basis for 14 CFR § 21.101(f) Aircraft.**

**a.** For aircraft type certificated under 14 CFR §§ 21.17(b), 21.24, 21.25, and 21.27, the certification bases are the applicable regulations – and their amendments in effect on the date of application – that the Administrator finds appropriate for the change. When selecting a certification basis for a change, an applicant may elect to show compliance to an earlier amendment under 14 CFR § 21.101(b). The exceptions in 14 CFR § 21.101(c) do not apply to categories of products in 14 CFR § 21.101(f). See appendix 3 for an overview of how the Changed Product Rule is applied to develop the certification basis for these other aircraft.

**b. Special Classes Aircraft.** For special classes of aircraft certificated under 14 CFR § 21.17(b), including the engines and propellers installed on them, the applicable requirements for the changed product will be portions of airworthiness requirements in 14 CFR parts 23, 25, 27, 29, 31, 33, and 35 that the Administrator found to be appropriate for the aircraft and applicable to the specific type design. The Administrator may designate other airworthiness criteria that are appropriate for the change based on the aircraft's intended use and the standards for establishing the original certification basis.

**c. Primary Category Aircraft.** For primary category aircraft certificated under 14 CFR § 21.24, the applicable airworthiness requirements are in 14 CFR parts 23, 27, 31, 33, and 35, or other requirements that the Administrator finds appropriate for the change. These requirements must apply to the specific design and the aircraft's intended use. They also provide a level of safety acceptable to the Administrator.

**d. Restricted Category Aircraft.** For a change to an aircraft certificated in the restricted category under 14 CFR § 21.25(a)(1), complying with the latest regulations would not normally contribute materially to the level of safety or be practical for its intended use. However, if the regulations incorporated in the type certificate do not provide an appropriate level of safety for the aircraft's intended use, the changed product must comply with a later appropriate regulation.

(1) If the change includes design features that were not foreseen when the existing certification basis was established, and there are later regulations or amendments that address these features, the change must comply with the appropriate later regulations. In this case, start with the requirements in the existing certification basis – and examine subsequent amendments – to arrive at a requirement that provides a level of safety appropriate for the product's intended use. If the change contains “novel” or “unusual” (14 CFR § 21.101(d)) design features for which there are no applicable later regulations, special conditions are required.

(2) An example of a change that included design features that were not foreseen when the aircraft was originally certified is a change that replaces reciprocating engines with turbopropeller engines. In this case, the original certification basis did not contain regulations for turbine engine installations. We must use later amendments to provide an appropriate level of safety for the aircraft's intended use.



e. Restricted Category Aircraft – Military Aircraft. The Administrator accepts aircraft type certificated in the restricted category under 14 CFR § 21.25(a)(2) based on their U.S. military service history. Because the Administrator did not certificate many of these aircraft to a specific set of airworthiness standards, the table in 14 CFR § 21.27 for surplus military aircraft is used to set an appropriate equivalent civilian certification basis. Title 14 CFR § 21.101(f) requires that the Administrator apply the latest amendments to significant changes to these products, but the latest amendments may not be appropriate for the aircraft's intended use. Earlier regulations that do not predate the equivalent certification basis are acceptable. If these regulations do not include design standards that apply to the change, later regulations appropriate to the product category will be applied. The goal is to maintain a level of safety appropriate for the aircraft's intended use.

f. Limited Category Aircraft. Limited category aircraft are surplus military aircraft, mostly from World War II, that were type certificated under part 9 of the CAR for use other than air transport. These aircraft were not intended to carry persons or property for hire, and normally were accepted based on their previous military qualifications and service record. A change to aircraft not supported by the military service history must comply with appropriate airworthiness standards. The level of safety associated with earlier standards may be acceptable for limited category aircraft.

g. Surplus Military Aircraft. Aircraft type certificated under 14 CFR § 21.27 are entitled to a TC in the normal, utility, acrobatic, commuter, or transport category. These aircraft were designed and constructed in the United States, accepted for operational use, and declared surplus by the U.S. Armed Forces. These aircraft may be counterparts, and are considered equivalent, to the previously civil certificated aircraft. Product changes or modifications to these aircraft are certificated in the same manner as their civil counterparts.

**14. Delegation Authority.** Title 14 CFR 21.101(b) (1) allows an applicant to comply with earlier regulations for a design change that the Administrator determines to be “not significant.” An applicant may classify a change as “not significant” using the criteria and examples in AC 21.101-1, Change 1.

a. The applicant can propose the classification and the Administrator can make a determination of “not significant” based on the applicant's classification. This will normally be done as part of the CPN process before the project proceeds. Or, a representative of the Administrator may make a determination of “not significant,” on the Administrator's behalf, without further finding.

b. To make a determination of “not significant” on the Administrator's behalf without further finding, there must be a written agreement between the cognizant Aircraft Certification Office (ACO) and the applicant that defines the system the applicant will use to apply the criteria in AC 21.101-1, Change 1. The written agreement must include a description of the delegation system the applicant will use to make the determination. The agreement may be a stand-alone document or may be part of an existing agreement, such as a Partnership for Safety Plan, Organizational Procedures Manual, the applicant's quality manual, or an existing memorandum of agreement.

c. The applicant may have an existing design control system that satisfies this requirement. An acceptable system will include procedures to classify changes as “not significant” and will address changes that were not foreseen in the existing certification basis.

d. The agreement between the ACO and the applicant must describe the design control system to ensure the applicant is consistently applying the criteria. The Administrator’s oversight is achieved by monitoring the applicant’s project notification and design control system.

#### **15. Documenting Changes to a Product’s Certification Basis.**

a. All changes that revise the product’s certification basis must be documented on the TC or STC. The certification basis for changes to TCs and STCs requires that the applicant documents the regulations, as well as the regulations’ amendment levels. Appendix 1 identifies samples of how to document a certification basis.

b. Complete the TC or STC before issuing the design approval. Send a copy of the TC to the accountable directorate and AIR-140 after the design change approval is issued. The certification basis must be readily available to applicants modifying type certificated products. The certification basis on amended TCs, STCs, and amended STCs must be available to other companies or individuals upon request from the ACO that issued or amended the document.

**16. Records Management.** Refer to Orders 0000.1, FAA Standard Subject Classification System, 1350.14, Records Management, and 1350.15, Records Organization, Transfer, and Destructions Standards, or your office Records Management Officer (RMO)/Directives Management Officer (DMO) for guidance regarding retention or disposition of records.

David W. Hempe  
Manager, Aircraft Engineering Division,  
Aircraft Certification Service

**APPENDIX 1. SAMPLES OF DOCUMENTING A CERTIFICATION BASIS**

This appendix gives two samples of documenting a TCDS or STC certification basis, appendix 1, figure 1. The first describes a Boeing 737-300 passenger to freighter configuration (including full cargo floor, main deck cargo door, interior and associated systems). The appendix 1, figure 2, shows the type design of the Windjet 100 series airplane which is a generic continuation sheet for a Windjet 100 to a 100AC model change conversion.

For product level changes described in this order, the examples are significant per 14 CFR §§ 21.115 and 21.101, and Advisory Circular 21.101-1, Change 1. The resultant certification basis combines the latest, intermediate, and existing regulations. The intermediate and existing regulations were derived through the application of 14 CFR 21.101(b), contribution to the level of safety, and impracticality.

The product can partially comply with a particular amendment level of a part (see appendix 1, figure 2). In these cases, document partial compliance paragraph by paragraph.

APPENDIX 1. SAMPLES OF DOCUMENTING A CERTIFICATION BASIS

FIGURE 1. SAMPLE DOCUMENTING A CERTIFICATION BASIS

United States Of America  
Department of Transportation - Federal Aviation Administration

# Supplemental Type Certificate

Number ST00001DC

This Certificate  
issued to

US Cargo Conversion Company  
5201 Tranquility Lane  
Colorful, Colorado 80110

certifies that the change in the type design for the following product with the limitations and conditions therefore as specified hereon meets the airworthiness requirements of Part 25\* of the Federal Aviation Regulations.

Original Product Type      A16WE  
Certificate Number:  
Make:                      Boeing  
Model:                    737-300

*Description of Type Design Change:* Conversion of a Boeing 737-300 passenger configuration to freighter configuration (including full cargo floor, main deck cargo door, interior and associated systems) in accordance with PCCC Master Drawing List PC-001, Revision B, dated March 23, 2001, or later FAA-approved revisions.

*Limitations and Conditions:* The installation should not be incorporated in any aircraft unless it is determined that the interrelationship between this installation and any previously approved configuration will not introduce any adverse effect upon the airworthiness of the aircraft.

Date of application: March 20, 2001

Date reissued:

Date of issuance: April 24, 2001

Date amended:

By direction of the Administrator



(Limitations and  
Conditions continued  
on page 3 of 4)

\_\_\_\_\_  
(Signature)  
Manager, Certification Procedures Branch  
Aircraft Engineering Division

T  
\_\_\_\_\_  
(Title)

his  
certificate  
and the supporting data which are the bases  
for approval shall remain in effect until surrendered,  
suspended, revoked, or a termination date is otherwise  
established by the Administrator of the Federal Aviation  
Administration.

4/21/03

8110.48  
Appendix 1

**APPENDIX 1. SAMPLES OF DOCUMENTING A CERTIFICATION BASIS**  
**FIGURE 1. SAMPLE DOCUMENTING A CERTIFICATION BASIS**

*Any alteration of this certificate is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years, or both.*

---

FAA Form 8110-2(10-68)

Page 1 of 3

*This certificate may be transferred in accordance with FAR 21.47.*

**APPENDIX 1. SAMPLES OF DOCUMENTING A CERTIFICATION BASIS**  
**FIGURE 1. SAMPLE DOCUMENTING A CERTIFICATION BASIS**

United States Of America  
 Department of Transportation - Federal Aviation Administration

**Supplemental Type  
 Certificate**  
 (Continuation Sheet)  
 Number ST00001DC

**Certification Basis:**

Based on 14 CFR §§ 21.115 and 21.101, and the FAA policy for significant changes in FAA Order 8110.48, the certification basis for the Boeing Model 737-300 series passenger to Freighter is as follows:

- a. The type certification basis for Boeing Model 737 series airplanes is shown on TCDS A16WE for parts **not changed or not affected** by the change.
- b. The certification basis for parts **changed or affected** by the change since the reference date of application, March 20, 2001, is based upon part 25 as amended by Amendment 25-101. Based on 14 CFR §§ 21.115 and 21.101, and the FAA policy for significant changes in FAA Order 8110.48, the certification basis for this modification was determined to be:

**Regulations at the latest amendment 25-0 through 25-101**

25.1 - 25.31, 25.301 - 25.307, 25.561 - 25.563, 25.581, 25.601 - 25.625, 25.671 - 25.689, 25.729, 25.777, 25.783 - 25.793, 25.801 - 25.812, 25.843, 25.851 - 25.869, 25.871, 25.903, 25.1301, 25.1309, 25.1322 - 25.1326, 25.1351 - 25.1363, 25.1411 - 25.1423, 25.1431 - 25.1461, 25.1501, 25.1519 - 25.1533, 25.1541 - 25.1563, 25.1581 - 25.1585, Appendix F

**Regulations at an intermediate amendment**

25.574           Amendment 25-54  
 25.629           Amendment 25-46  
 Appendix H     Amendment 25-54

**Regulations at the amendment level in TCDS A16WE**

25.25, 25.321 - 25.373, 25.471 - 25.519, 25.731 - 25.735, Appendix G

- If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission.

-----END-----

*Any alteration of this certificate is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years, or both.*

4/21/03

8110.48  
Appendix 1

**APPENDIX 1. SAMPLES OF DOCUMENTING A CERTIFICATION BASIS**  
**FIGURE 1. SAMPLE DOCUMENTING A CERTIFICATION BASIS**

FAA Form 8110-2(10-68)

Page 3 of 3

*This certificate may be transferred in accordance with FAR 21.47.*

**APPENDIX 1. SAMPLES OF DOCUMENTING A CERTIFICATION BASIS****FIGURE 2. SAMPLE DOCUMENTING A CERTIFICATION BASIS (CONTINUED)**

The type design of the Windjet 100 series airplanes was approved by issuing Type Certificate A11DC. The Windjet 100 series airplanes were certified to amendment 22 of 14 CFR part 25. In June 2000, the TC was amended to include the Windjet 100AC. The Windjet 100AC is a retrofit of a Windjet 100 airplane with an Advanced Cockpit (AC). The following is based on information from the Windjet 100 Type Certificate Data Sheet (TCDS):

**1.** For all Model Windjet 100AC airplanes, issuance of a TC is based on compliance with the following:

**a.** Conversion of a Windjet 100 to a Windjet 100AC can be accomplished by Windjet Aircraft Drawing SP10000.

**b.** The Certification Basis is defined as:

**(1)** Title 14 CFR part 25, dated February 1, 1965, with Amendments 1 through 22 “Airworthiness Standards: Transport Category Airplanes,” and 14 CFR § 25.471 of Amendment 25-23, for all areas not affected by the change.

**(2)** Title 14 CFR part 25, dated February 1, 1965, including Amendments 25-1 through 25-89 for the change and all areas affected by the change. The following lists the Federal Aviation Regulations complied with through Amendment Level 25-89.

25. 125	25. 605	25. 685	25. 841	25. 1039	25. 1326	25. 1435	25. 1541
25. 145	25. 607	25. 689	25. 843	25. 1141	25. 1327	25. 1439	25. 1543
25. 149	25. 609	25. 693	25. 855	25. 1142	25. 1329	25. 1441	25. 1545
25. 207	25. 611	25. 699	25. 857	25. 1145	25. 1331	25. 1443	25. 1549
25. 301	25. 613	25. 703	25. 858	25. 1161	25. 1333	25. 1445	25. 1551
25. 303	25. 615	25. 729	25. 863	25. 1165	25. 1335	25. 1447	25. 1553
25. 305	25. 619	25. 733	25. 901	25. 1207	25. 1337	25. 1449	25. 1555
25. 307	25. 621	25. 771	25. 903	25. 1301	25. 1351	25. 1451	25. 1563
25. 397	25. 623	25. 773	25. 943	25. 1303	25. 1353	25. 1453	25. 1581
25. 399	25. 625	25. 777	25. 952	25. 1305	25. 1355	25. 1457	25. 1583
25. 405	25. 629	25. 779	25. 954	25. 1307	25. 1357	25. 1459	25. 1585
25. 561	25. 671	25. 783	25. 961	25. 1325	25. 1419	25. 1461	25. 1587



**APPENDIX 1. SAMPLES OF DOCUMENTING A CERTIFICATION BASIS**  
**FIGURE 2. SAMPLE DOCUMENTING A CERTIFICATION BASIS (CONTINUED)**

(3) The following lists the exceptions to compliance with Amendment 25-89 to the Federal Aviation Regulations:

<u>SECTION NO.</u>	<u>TITLE</u>	<u>AT AMENDMENT 25-</u>
25.365	Pressurized Compartment Loads	54*
25.562	Emergency Landing Dynamic Conditions	64**
25.571	Damage-Tolerance and Fatigue Evaluation	0,89***
25.631	Bird Strike Damage	0,89***
25.807(c)(3)	Emergency Exits	15
25.813	Emergency Exit Access	45,89***
25.1141(f)	Power Plant Controls: General	11****
25.1309	Equipment, Systems and Installations	0,89***
25.1419(c)	Ice Protection	23,89***

\* Exception only for interior partition at body station 120.

\*\* Exception for front row Head and Femur Injury Criteria (§25.562(c)(5)(6)) only.

\*\*\* Applicable to new or modified structures and systems, and portions of the airplane affected by the change. Where two amendment levels are shown for the same paragraph, the number without the asterisk (\*) applies to structures, systems and portions of the airplane that are not affected by the change. The structure, systems, and components which comply with the later amendments are identified and approved in Windjet Drawing SP10000.

\*\*\*\* *Exception applies to Auxiliary Power Unit spar mounted fuel shutoff valve only. All other power plant controls were shown to comply with § 25.1141 at amendment 25-89.*

Amendment level "0" is the original published version of part 25 (February 1, 1965).



**APPENDIX 2. SAMPLE CERTIFICATION PROGRAM NOTIFICATION**

**Subject:** **ACTION:** Certification Program Notification

**Date:**

**From:** Manager, (ACO)

**To:** Manager, XXX-110

Part A: (To be completed by office receiving application)

1. Project No.: \_\_\_\_\_
2. Model Designation: \_\_\_\_\_
3. Applicant: \_\_\_\_\_
4. Address: \_\_\_\_\_
5. Date of application: \_\_\_\_\_
6. Type of project: TC\_\_\_ ATC\_\_\_ STC\_\_\_ ASTC\_\_\_
7. Expected completion date: \_\_\_\_\_
8. Project Manager: \_\_\_\_\_ Telephone Number \_\_\_\_\_
9. Project Engineer: \_\_\_\_\_
10. Description: \_\_\_\_\_
11. We do \_\_\_ / do not \_\_\_ consider this a significant project per Order 8110-4b.
12. We do \_\_\_ / do not \_\_\_ consider this a significant change per 14 CFR § 21.101(b)(1)
13. CSTA Involvement? Yes\_\_\_\_\_ No \_\_\_\_\_ Not Determined\_\_\_\_\_
14. AEG Involvement? Yes\_\_\_\_\_ No \_\_\_\_\_ Not Determined\_\_\_\_\_

\_\_\_\_\_  
Manager, (project, or ACO, etc.)

Part B: (To be completed by Directorate)

**Date:**

**From:** Manager, XXX-110

**To:** Manager, (ACO)

We do \_\_\_ / do NOT \_\_\_ consider this program to be significant and have assigned  
\_\_\_\_\_ as our Project Officer.

Please do \_\_\_ / do NOT \_\_\_ submit a draft Certification Program Plan.

Signature authority ( ) is / ( ) is NOT delegated to your office.

***Directorate ACOS Project No.:***

## A. Language

### Appendix 3. Application of the New Rule

Category	If the certification basis is ...	Then, the starting point for modifications to existing aircraft is ...	And the applicant should ...
21.17 (b) Special Class	Portions of 14 CFR Parts 23, 25, 27, 29, 31, 33, or 35	Latest amendment of applicable 14 CFR sections	Consider intended use (passengers, flight instruction)
	Other than FARs, for example, JAR 22, JAR VLA	Existing certification basis	Use later or latest “other” standard based on intended use
21.24 Primary	Portions of 14 CFR Parts 23, 27, 31, 33, or 35	Latest amendment of applicable 14 CFR sections	Consider intended use (passengers, flight instruction)
	Other than FARs, for example, JAR	Existing certification basis	Use later or latest “other” standard based on intended use
21.25a(1) Restricted	Portions of 14 CFR Parts 23, 25, 27, 29, 31, 33, or 35; CAR 3, CAM 8	Latest amendment of applicable 14 CFR sections	Consider intended use based on special purpose
21.25a(2) Restricted or Limited (CAR 9)	Based on military qualification acceptance and service history	14 CFR § 21.27(f) table	Consider intended use based on special purpose
21.27 Surplus Military	Portions of 14 CFR Parts 23, 25, 27, 29, 31, 33, or 35 and predecessor regulations	Latest amendment of applicable 14 CFR sections	Consider intended use, including standard airworthiness certificates

**Appendix F**  
**AC 21.101-1, Change 1**

The CPR AC begins on the next page.

This is NOT the signed, final version. This is *DRAFT* version 4/15/2003.





U.S. Department  
of Transportation

**Federal Aviation  
Administration**

# Advisory Circular

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**Subject: ESTABLISHING THE  
CERTIFICATION BASIS OF  
CHANGED AERONAUTICAL  
PRODUCTS**

**Date: 4/15/03**

**AC No: 21.101-1  
Change: 1**

---

## **1. PURPOSE.**

a. This Advisory Circular (AC) provides guidance for establishing the certification basis for changed aeronautical products and identifying the conditions under which it will be necessary to apply for a new type certificate. Title 14, Code of Federal Regulations (14 CFR) § 21.101 requires an applicant for a change to a type certificate to meet the latest requirements, except where the change is not significant, where areas of the product are not affected, where it would be impractical, or where it would not contribute materially to the level of safety of the changed product. Title 14 CFR § 21.19 identifies the conditions under which an applicant for a design change is required to make application for a new type certificate. This AC discusses and explains the criteria of 14 CFR §§ 21.19 and 21.101, and their application. It provides guidance as to the assessment of significant vs. not significant changes to the type certificated product. This document also provides guidance for the determination of substantial vs. significant changes.

b. The intent of 14 CFR § 21.101 is to enhance safety through the incorporation of the latest requirements in the certification basis for changed products. This AC describes the application of the latest airworthiness requirements for the certification of significant design changes to aircraft, aircraft engines, and propellers. Significant changes are generally distinct from the vast majority of major changes. In the assessment of whether a change is significant, all previous relevant design changes need to be taken into consideration along with any previous updates to the certification basis. All changes must be FAA approved, however, an applicant may comply with earlier amendments to the regulations based upon a finding by the Administrator that the change is not significant, an area is not affected by a change, or compliance with the latest regulation is impractical or does not contribute materially to the level of safety. Each change must be judged on its own merit when making the final determination of the certification basis.

c. This AC is not mandatory and is not a regulation. It outlines one method of compliance with 14 CFR § 21.101. The applicant may elect to follow an alternate method, provided the alternate method is acceptable to the Administrator. Because the method of compliance presented in this AC is not mandatory, the term “must” used herein applies only to an applicant who chooses to follow this particular method without deviation.

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## 2. APPLICABILITY.

**a.** This document supersedes AC 21.101-1, dated August 8, 2001. This AC is applicable to changes to a type certificate under 14 CFR § 21.101. Minor design changes are approved under 14 CFR § 21.95, and are considered to be not significant under 14 CFR § 21.101. This AC applies equally to applications made for type certificate amendments, supplemental type certificates (STCs), or amended STCs.

**b.** This AC is also applicable to all significant design changes to aircraft (other than rotorcraft) of 6,000 lbs. or less maximum weight, or to a non-turbine rotorcraft of 3,000 lbs. or less maximum weight (excepted aircraft per 14 CFR § 21.101 (c)). Unless the



Administrator finds the change significant in an area, an applicant may show that the changed product complies with the requirements incorporated in the type certificate.

c. This AC is also applicable for aircraft certificated under 14 CFR §§ 21.17(b), 21.24, 21.25, and 21.27.

**3. RELATED CODE OF FEDERAL REGULATIONS PARAGRAPHS.**

a. 14 CFR § 21.16, Special conditions.

b. 14 CFR § 21.17, Designation of applicable regulations.

c. 14 CFR § 21.19, Changes requiring a new type certificate.

d. 14 CFR § 21.21, Issue of type certificate: normal, utility, acrobatic, commuter, and transport category aircraft; manned free balloons; special classes of aircraft; aircraft engines; propellers.

e. 14 CFR § 21.93, Classification of changes in type design.

f. 14 CFR § 21.101, Designation of applicable regulations.

g. 14 CFR § 21.115, Applicable requirements.

**4. EXPLANATION OF TERMINOLOGY.** The following is a summary of the terminology used throughout this advisory material. Further explanation of some of these terms is found in paragraphs 6, 7, and 8.

a. Certification basis – The applicable airworthiness requirements as established in 14 CFR §§ 21.17 and 21.101, as appropriate; special conditions; equivalent level of safety findings; and exemptions applicable to the product to be certificated.

**NOTE:** This AC is not intended to be used to determine the applicable aircraft noise, fuel venting, and exhaust emission requirements for changed products.

b. Earlier requirements – The requirements in effect prior to the date of application for the change, but not prior to the existing certification basis.

c. Existing certification basis – The requirements incorporated by reference in the type certificate of the product to be changed.

d. Latest requirements – The requirements in effect on the date of application for the change.

e. Previous relevant design changes – Previous design changes, the cumulative effect of which could result in a product significantly or substantially different from the original product or model, when considered from the last time the latest regulations were applied.

**f. Product level change** – A change or combination of changes that makes the product distinct from other models of the product (for example, range, payload, speed). Product level change is defined at the aircraft, aircraft engine, or propeller level of change.

**g. Significant change** – A change to the type certificate is significant to the extent that it changes one or more of the following: general configuration, principles of construction, or the assumptions used for certification, but not to the extent to be considered a substantial change. The significance of the change must be considered in the context of all previous relevant design changes and all related revisions to the applicable regulations. Not all changes or product level changes are significant.

**h. Substantial change** – A change which is so extensive that a substantially complete investigation of compliance with the applicable regulations is required, and consequently a new type certificate, in accordance with 14 CFR § 21.19.

## **5. GENERAL OVERVIEW OF 14 CFR § 21.101.**

**a.** Title 14 CFR § 21.19 specifies changes that require a new type certificate. When a new type certificate is required, 14 CFR § 21.17 specifies the applicable requirements for the changed product.

**b.** When an application for a new type certificate is not required by 14 CFR § 21.19, 14 CFR § 21.101 defines the designation of applicable requirements for determining the certification basis for the changed product.

**c.** Title 14 CFR § 21.101(a) requires a change to a type certificated product to comply with the latest requirements, unless the change meets the criteria for the exceptions identified in 14 CFR §§ 21.101(b) and (c). The certification basis should not be dependent on whether the type certificate holder or an applicant for a supplemental type certificate is originating the change. Where compliance with a later amendment for a significant change does not contribute materially to the level of safety, would be impractical, or is in an area not affected by the change, the applicant may comply with earlier requirements. However, the applicant may not use requirements prior to those specified by the existing certification basis.

**d.** Title 14 CFR § 21.101(b) pertains to changes for which earlier requirements provide adequate standards. Earlier requirements may be used when the change is not significant. In cases where design changes involve features that have no associated regulatory standard in the existing certification basis, the Administrator will review the proposed certification plan to ensure the adequacy of the requirements against the proposed design change.

**e.** Title 14 CFR § 21.101(b)(1) allows the applicant to show compliance with an earlier amendment when the Administrator determines the change is not significant. Title 14 CFR 21.101(b)(1)(i) and (ii) pertains to changes that meet the automatic criteria where the change is significant. Title 14 CFR §§ 21.101(b)(2) and (b)(3) allows the use of earlier requirements for significant changes for areas of the product not affected by the

change and for cases where compliance to the latest requirements would not contribute materially to the level of safety or would be impractical. Note that earlier amendments may not precede either the corresponding regulation incorporated in the type certificate, or any requirement found in 14 CFR §§ 23.2, 25.2, 27.2, or 29.2.

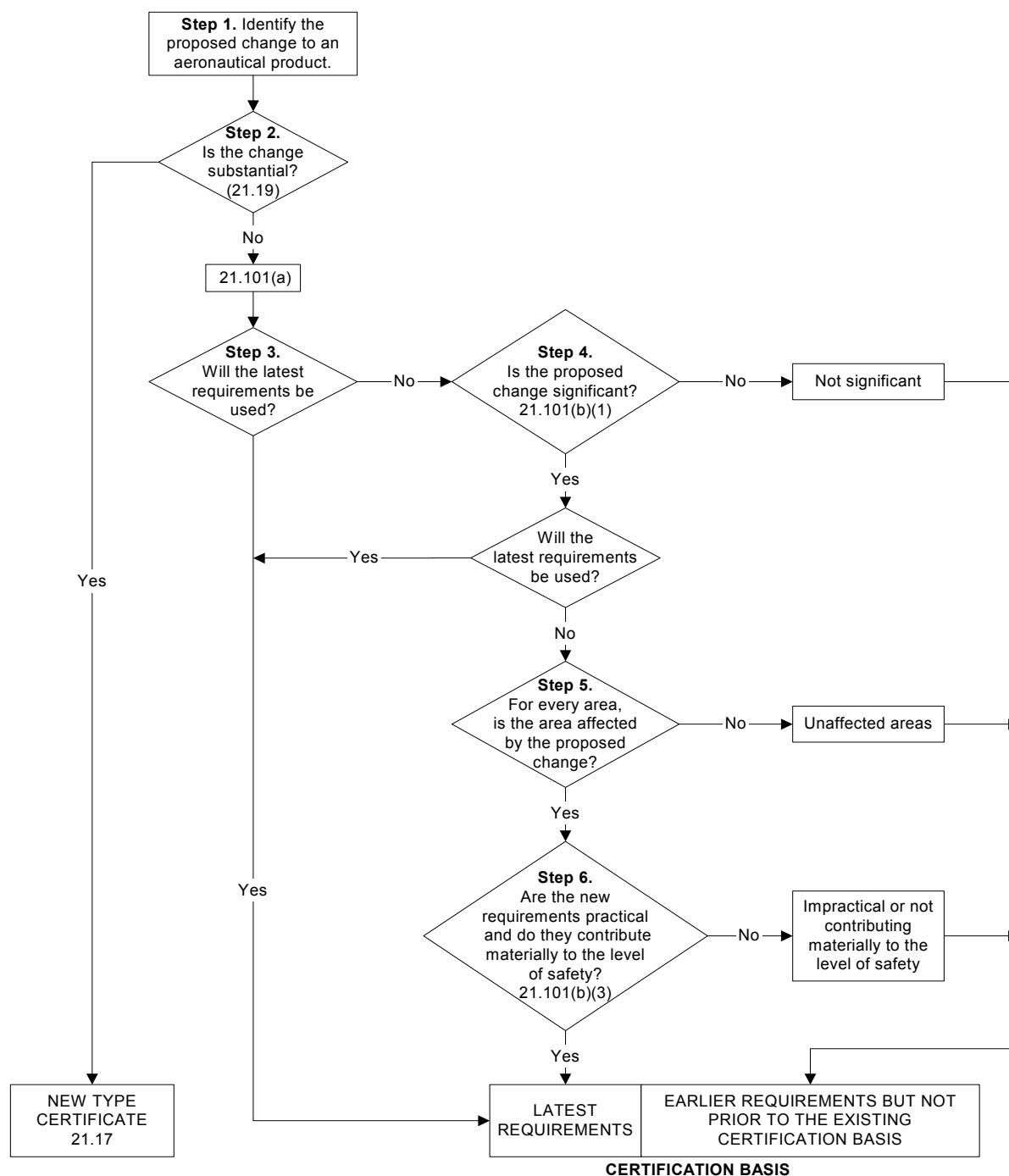
**f.** Title 14 CFR § 21.101(c) provides an exception to the requirements of 14 CFR § 21.101(a). An applicant for a change to an aircraft (other than rotorcraft) of 6,000 pounds or less maximum weight, or to a non-turbine rotorcraft of 3,000 pounds or less maximum weight, may show that the changed product complies with the regulations incorporated by reference in the type certificate. The applicant may elect to comply with the later regulations. If the Administrator finds that the change is significant in an area, the Administrator may designate compliance with a later amendment to the regulations incorporated by reference in the type certificate that applies to the change and any regulation the Administrator finds is directly related. See paragraph 9 of the AC for specific guidance on this provision.

**g.** Title 14 CFR § 21.101(d) provides for the use of special conditions, as prescribed under 14 CFR § 21.16, when the existing certification basis or the latest regulations do not provide adequate standards with respect to the proposed change because of a novel or unusual design feature.

**h.** Title 14 CFR § 21.101(e) prescribes the effective period an application will remain valid for a change to a type certificate. This section is consistent with the requirements of 14 CFR § 21.17 for a new type certificate.

**i.** Title 14 CFR § 21.101(f) pertains to aircraft certificated under the requirements of 14 CFR §§ 21.17(b), 21.24, 21.25, and 21.27 airworthiness requirements.

**j.** Figure 1 provides a flowchart of the process to determine the applicable certification basis for a proposed design change under 14 CFR § 21.101, following a determination that the proposed design change is not substantial under 14 CFR § 21.19.

**Figure 1: Establishing the certification basis for changed products**

**NOTE 1:** In the vast majority of cases, the applicant will proceed to Step 4 as the initial step in the process. See paragraph 6 for guidance.

**NOTE 2:** For excepted products under 14 CFR § 21.101(c), see paragraph 9. For conditions under 14 CFR § 21.101(d), see paragraph 10.

**6. ESTABLISHING THE CERTIFICATION BASIS FOR CHANGED PRODUCTS, 14 CFR §§ 21.101(b)(1).**

**a.** The administrative burden for the applicant is to demonstrate, and for the Administrator to find, that a changed product is significant or not significant, and to determine the resulting certification basis. The certification basis can vary depending on the magnitude and scope of the change. The steps below present a streamlined approach of making this determination. In addition to assisting in the determination of significance, this guidance will help establish the appropriate amount of coordination required between the applicant and the Administrator.

**b.** Classifications of typical changes are in the tables of Appendix 1. For instructions on how to use the Appendix 1 tables, proceed to step 4 below. In cases where the classification in Appendix 1 is not applicable or immediately obvious for the proposed change, the following steps should be used in conjunction with Figure 1 to determine the appropriate certification basis for the changed product. All other areas of the aircraft are considered to be unchanged or not affected by the change and continue to comply with the existing certification basis.

***c. Step 1 of Figure 1. Identify the proposed change to an aeronautical product.***

**(1)** The applicant must, as a first step, identify the proposed change to the aeronautical product. An applicant for a change to a type certificate must consider all previous relevant design changes to the aeronautical product. Changes to a product can include physical design changes, changes to an operating envelope, and/or performance changes. The change may be a single change or a collection of changes.

**(2)** For each change, it is important that the effects of the change on other systems, components, equipment, or appliances of the product are properly assessed. The characteristics affected by the change are not only physical changes. The intent is to encompass all aspects where there is a need for re-evaluation, that is, where the substantiation presented for the product being changed should be reviewed, updated, or rewritten. All other areas of the aircraft are considered to be unchanged or not affected by the change and can continue to comply with the existing certification basis.

***d. Step 2 of Figure 1. Is the change substantial?***

**(1)** Title 14 CFR § 21.19 requires that an applicant obtain a new type certificate for a changed product if the change in design, power, thrust, or weight is so extensive that a substantially complete investigation of compliance with the applicable regulations is required. A new type certificate could be required for either an extensive change to a previously type certificated product or for a new design derived through a series of design changes from a previously type certificated product. The need for a new type certificate may be obvious when the change is first considered or may need a more extensive evaluation through application of 14 CFR § 21.101.

**(2)** A “substantially complete investigation” of compliance is required when most of the existing substantiation is not applicable to the changed product. The question

of whether a change is substantial must be addressed at the beginning of the process. However, if at any point while developing the certification basis, it becomes clear that the proposed change is a substantial change, the process ceases to be an amendment process under 14 CFR Part 21, Subpart D and becomes a new type certificate process under 14 CFR Part 21, Subpart B.

(3) If it is not initially clear that a new type certificate is required, Appendix 1 provides some examples of substantial changes to aid in this classification.

(4) In considering the above, a substantial change will require a new type certificate, therefore, 14 CFR § 21.19 applies; if the change is not substantial, 14 CFR § 21.101 applies.

***e. Step 3 of Figure 1. Will the latest requirements be used?***

(1) Where the latest requirements are used, the intent of 14 CFR § 21.101 has been met, including the case where the applicable requirements have not changed since the previous update of the certification basis, or where the applicant elects to comply with the latest amendments.

***f. Step 4 of Figure 1. Is the proposed change significant? 14 CFR § 21.101(b)(1)***

(1) Significant changes are typically product level changes and, by their very nature, distinct from the vast majority of minor changes. In general, these changes are either the result of an accumulation of changes or occur through an isolated extensive major change rising to the product level that makes the changed product distinct from others. Additionally, 14 CFR § 21.101(b)(1) defines a significant change as existing when one or more of three automatic criteria apply: (1) the general configuration is not retained; (2) principles of construction are not retained; and (3) the assumptions used for certification of the product do not remain valid. In many cases, a significant change may involve more than one of these criteria and will be obvious and distinct from other product improvements or production changes.

(2) Previous relevant design changes of the product can trigger one or more of the automatic criteria listed in 14 CFR §§ 21.101(b)(1)(i) and (ii) for the proposed design change. When assessing the design change, either singularly or collectively, the cumulative effect of previous relevant design changes must be considered. These design changes may have been incorporated through earlier changes in the type certificate on areas related to the current proposed change and the associated areas, systems, components, equipment, or appliances. The collective result may be a product considerably different from the latest updated certification basis for the product or model. For example, previous relevant aircraft design changes may address incremental increases in weight or thrust that, while individually not significant (for example, 2%, 4%, 5% discrete increases), can, through a series of changes, achieve a significant product level change.

(3) The applicant may use the tables in Appendix 1 and the criteria described in paragraph 7 as guidance to make the classification of significant. The examples of significant and not significant changes in Appendix 1 are predicated upon more than 10 years of international certification experience. One or more of the three automatic criteria

in 14 CFR § 21.101(b)(1) were found in all cases where the changes were identified as significant. Other criteria reflecting significance were not found. The concept of having only the three automatic criteria seems to fit most projects. Therefore, typically only when one or more of the three criteria is affected is the design change considered significant. The starting point to begin accumulating previous relevant design changes is the time the latest applicable requirements were applied in the affected area, system, component, equipment, or appliance.

(4) Typically, a change to a single area, system, or component will not result in a product level change. However, there may be distinct cases where the change to a single system or component may, in fact, result in a significant change due to its effect on the product overall.

#### **7. USING THE CRITERIA TO DETERMINE SIGNIFICANCE AT THE PRODUCT LEVEL, 14 CFR §§ 21.101(b)(1)(i) and (ii) (Step 4).**

a. Typically, significant product level changes result in a model change necessitating an amendment to the type certificate or an STC that rises to the level of an amended type certificate. Note that applications for a new model not associated with hardware changes, that is, commercial considerations, are not an indication of a significant change under 14 CFR § 21.101. All changes are considered in light of the change itself and its classification.

b. The following definitions build upon the criteria identified in the rule and provide additional guidance on how to apply the criteria when classifying product level changes. In cases of doubt, and to ensure a consistent outcome, the applicant is encouraged to seek the advice of the Aircraft Certification Office.

(1) Changes Where the General Configuration is Not Retained (Significant Change to General Configuration). A change to the general configuration of the product level that is likely to require a new model designation because of the need to distinguish the different product from other product models, for example, performance or interchangeability of major components.

(2) Changes Where the Principles of Construction are Not Retained (Significant Change to Principles of Construction). A change at the product level to the materials and/or construction methods that affect the overall products' operating characteristics or inherent strength and would require extensive reinvestigation to show compliance.

(3) Changes that Invalidate the Assumptions used for Certification (Significant Change to the Assumptions used for Certification). A change to the product level assumptions associated with the compliance demonstration, performance, or operating envelope that by itself is so different that the original assumptions are invalidated. Examples may include:

- (a) Change of an aircraft from an unpressurized to pressurized fuselage;
- (b) Change of operation of a fixed wing aircraft from land-based to water-based; and
- (c) Operation envelope expansions that are outside the existing design parameters and capabilities.

**NOTE:** Merely operating a product to an expanded envelope for which it was originally designed is generally not a significant change. In this case, the assumptions used for certification of the basic product remain valid and the results can be applied to cover the changed product with predictable effects or can be demonstrated without significant physical changes to the product.

c. The above criteria are used to determine if a change is significant. In applying the automatic criteria and the examples in Appendix 1, the applicant should focus on the change itself. Consideration of only the latest certification requirements is not reason enough to cause a classification of significance under 14 CFR § 21.101.

d. Appendix 1 includes tables of typical changes for transport aircraft, small aircraft, rotorcraft, and engines/propellers that meet the definition of a significant change for each product line. The appendix also includes typical changes that do not achieve the significant level. The tables can be used in one of two ways:

(1) To classify a proposed change that is listed in the table, or

(2) In conjunction with the three automatic criteria, to help classify a proposed change not listed in the table.

e. If the change is classified as:

(1) Significant (14 CFR §§ 21.101(b)(1) and (2)). The applicant will comply with the latest amendments of the applicable requirements for certification of the changed product. The applicant can use the exceptions in 14 CFR §§ 21.101(b)(2) and/or (3) to show compliance with earlier amendments. The final certification basis may consist of a combination of the latest, and earlier or existing requirements for the change.

(2) Not Significant (14 CFR § 21.101(b)(1)). The applicable requirements are those contained in the existing certification basis. The applicant may elect to comply with later amendments.

**NOTE:** In cases where no regulatory standards are defined in the existing certification basis for the design change but applicable regulatory standards exist in a subsequent amendment to the regulations, the subsequent amendment will be made part of the certification basis.

f. Making the Classification. A classification of significant or not significant can be made (the application of 14 CFR § 21.101(b)(1)) in one of two ways:

(1) By delegation, where appropriate guidelines are in place to support a classification of not significant by the applicant. The Administrator may accept the not significant determination without further evaluation and rely on the applicant's design control system and the Administrator's oversight system to monitor and validate decisions; or



(2) By the Administrator accepting the determination of significance relevant to a major modification based on the data submitted by the applicant.

g. At this point the determination of significant or not significant has been made. For significant changes, if the applicant proposes to show compliance with an earlier requirement, the procedure outlined in paragraph 8 should be used.

**8. SHOWING COMPLIANCE WITH AN EARLIER REQUIREMENT,  
14 CFR §§ 21.101(b)(2) AND (3).**

a. For a design change that has been determined to be significant, 14 CFR §§ 21.101(b)(2) and (3) provide the exceptions from the requirement of 14 CFR § 21.101(a) to meet the latest requirements for design changes. An applicant may elect to show compliance with an earlier amendment level or with the existing certification basis for areas not affected by the change, and areas affected by the change for which compliance with the latest requirements would not contribute materially to the level of safety or would be impractical.

b. The earlier amendment level with which the applicant intends to show compliance may not precede the corresponding requirements in the existing certification basis. It is incumbent upon the applicant to demonstrate to the Administrator that compliance with the latest requirements does not contribute materially to the level of safety, or is impractical.

c. The following steps should be used in conjunction with Figure 1, when an applicant wishes to comply with an earlier requirement for a significant change:

***(1) Step 5 of Figure 1. Is the area affected by the proposed change?  
14 CFR § 21.101(b)(2)***

(a) A not affected area is any area, system, component, equipment, or appliance that is not affected by the proposed product level change. For a product level change, it is important that the effects of such change on other systems, components, equipment, or appliances of the product are properly assessed because areas that have not been changed may be affected. If the significant change does not affect the area, then the certification basis of that area need not be revisited.

(b) In assessing the affected areas, it may be necessary to identify secondary changes resulting from a product level change. The secondary changes may be changes in both physical aspects and/or performance characteristics that are part of, and consequential to, the overall product level change. Secondary changes may be evaluated to the existing certification basis for the product being changed; however, care should be taken to ensure that affected areas are not overlooked. The intent is to encompass all aspects where there is a need for re-evaluation.

(c) The following aspects of a product level change should be considered:

**(1) Physical aspects.** The physical aspects include, but are not limited to, structures, systems, equipment, components, and appliances (physical aspects can cover both “hardware” and “software”). When evaluating the physical aspects, it is necessary to make a distinction between the product level change and the resulting

secondary effects. An example of a secondary effect may be the lengthening and re-routing of the various airplane circuits as a result of a fuselage plug.

**(2) Performance/functional characteristics.** The less obvious aspect of the word “areas” covers general characteristics of the type certificated product, such as performance features, handling qualities, emergency provisions, fire protection, structural integrity, aeroelastic characteristics, or crashworthiness. These characteristics may be affected by a product level change. For example, adding a fuselage plug could significantly affect performance and handling qualities.

**(d)** All areas affected by the proposed design change must comply with the latest requirements, unless the applicant shows that demonstrating compliance with an amendment of a requirement would not contribute materially to the level of safety or would be impractical. Step 6 provides further explanation.

***(2) Step 6 of Figure 1. Are the new requirements practical and do they contribute materially to the level of safety? 14 CFR § 21.101(b)(3)***

**(a) Not contributing materially to the level of safety.** Compliance with the latest requirements could be considered “not to contribute materially to the level of safety” if the change to type design and/or relevant experience demonstrates a level of safety comparable to that provided by the latest requirements, or if compliance may compromise the existing level of safety for that particular changed product. The applicant must provide sufficient justification to allow the Administrator to make this determination. This exception could be applicable in the situations described in the paragraphs below:

**(1) Design.**

**(a)** This provision gives the opportunity to consider the consistency of design. For example, when a small fuselage plug is added, additional seats and overhead bins are likely to be installed, and the lower cargo hold extended. These components may be identical to the existing components. The level of safety may not be materially increased by applying the latest requirements only to the changed parts since the entire modified design may not be any safer than the original design. Similarly, there may be no safety benefit in applying later requirements to both the new and unaltered components. Compliance of the new areas with the existing certification basis may be acceptable.

**(b)** However, a fuselage plug may be large relative to the original certificated structure, seats, bins, doors, and cargo compartment. The change may require a new compliance substantiation that is comparable with that required for a new model airplane. In these circumstances the proposed certification basis should encompass the requirements in effect on the date of application for the change.

**(2) Service experience.**

**(a)** This provision permits the use of relevant service experience, such as fleet hours, to demonstrate that compliance with the latest requirements would not contribute materially to the level of safety, and as such the use of earlier requirements may be appropriate. Appendix 3 provides additional guidance on the use of service experience, along with examples.

**(b)** There may be cases for rotorcraft and small airplanes where sufficient and relevant data may not be available because of the reduced utilization and the different amount and type of data available. In such cases, other service history information may provide sufficient data to justify the use of earlier requirements, such as: warranty, repair, and parts usage data; accident, incident, and service difficulty reports; service bulletins; airworthiness directives; or other pertinent and sufficient data collected by the manufacturers, authorities, or other entities.

**(c)** The service experience levels necessary to demonstrate the appropriate level of safety as they relate to the proposed design change would have to be reviewed and agreed to by the Administrator.

**(3) Other exceptions.** Compliance with later requirements would not be required where the amendment is of an administrative nature and has been made only to correct errors or omissions, consolidate text, or clarify an existing requirement.

**(b) Impractical.** Compliance with the latest requirements may be considered impractical if the applicant can substantiate that it would result in additional resource requirements that are not commensurate with the safety benefits. The additional resource requirements could include those arising from design changes required for compliance and the effort required to demonstrate compliance, but would not include resource expenditures for prior product changes.

**(1)** Substantiating data and analyses must support an applicant's position that compliance is impractical, and the Administrator must agree with this position. In evaluating an applicant's position and substantiating data regarding impracticality, the Administrator may consider other factors (for example, the costs and safety benefits for a comparable new design).

**(2)** A review of transport category projects showed that in certain cases, where an earlier amendment to applicable requirements was allowed, design changes were made to nearly comply with the latest amendments. In these cases the applicant successfully demonstrated that full compliance would require a substantial increase in the outlay of resources with a very small increase in the level of safety. These cases reflect an appropriate application of "impracticality" to a changed product.

**(3)** A proposal that a product design change would be impractical would be used, in most cases, where compliance with the latest requirements would contribute materially to the level of safety, but this contribution may not be commensurate with the associated resource expenditures.

(4) Appendix 2 provides additional guidance and examples for determining impracticality.

(c) This completes the step-by-step process used in determining the certification basis for the changed product.

**9. EXCEPTED PRODUCTS UNDER 14 CFR § 21.101(c).**

a. An applicant for a change to an aircraft (other than rotorcraft) of 6,000 pounds or less maximum weight, or to a non-turbine rotorcraft of 3,000 pounds or less maximum weight, may show that the changed product complies with the regulations incorporated by reference in the type certificate. The applicant may elect to comply with the later regulations. If the Administrator finds that the change is significant in an area, the Administrator may designate compliance with a later amendment to the regulations incorporated by reference in the type certificate that applies to the change and any regulation the Administrator finds is directly related. Beginning with the existing certification basis, the Administrator will step through each progressive regulation to determine the amendment appropriate for the change. However, if the Administrator also finds that compliance with the amendment or regulation would not contribute materially to the level of safety of the changed product or would be impractical, the Administrator may allow compliance with an earlier amendment to that requirement initially designated or with the existing certification basis, depending on the proposed design change.

b. For a change that contains new design features that are novel and unusual, the Administrator will designate the applicable special conditions at the appropriate amendment level, beginning with the existing certification basis and progressing to the most appropriate later amendment level for the change. For a change that contains new features, which are not covered in the existing certification basis, the Administrator will designate the applicable airworthiness requirements at the appropriate amendment level, beginning with the existing certification basis and progressing to the most appropriate later amendment level for the change.

c. The exception for products under 14 CFR § 21.101(c) applies at the aircraft level only. Design changes to engines and propellers installed on these excepted aircraft are assessed as separate products using 14 CFR §§ 21.101(a) and (b).

**10. SPECIAL CONDITIONS, 14 CFR § 21.101(d).** Title 14 CFR 21.101(d) allows for the application of special conditions, or for changes to existing special conditions, to address the changed design. The objective is to achieve, for the significant change, a level of safety consistent with that provided by the requirements in effect on the date of application for the design change. The application of special conditions to a design change is not, in itself, a reason for it to be classified as either a substantial change or a significant change. When the change is not significant, the special conditions must be consistent with the agreed certification basis.

**11. EFFECTIVE PERIOD FOR AN APPLICATION TO CHANGE A TYPE CERTIFICATE, 14 CFR § 21.101(e).** Title 14 CFR 21.101(e) is intended to ensure that, at the time the changed product is certificated, no longer than three or five years, as appropriate to the product, had elapsed from the date of application. This is to ensure that

the certification basis for the changed product is as current as practical. This is consistent with the requirements of 14 CFR § 21.17 for a new type certificate and prescribes the process of updating the certification basis if these time limits are exceeded.

**12. OTHER CATEGORY AIRCRAFT, 14 CFR § 21.101(f).** For aircraft type certificated under 14 CFR §§ 21.17(b), 21.24, 21.25, and 21.27, the certification basis for the changed product will consist of the amendment levels of the applicable regulations that the Administrator finds appropriate for the change in effect on the date of application for the change. When selecting a certification basis for a change, an applicant may elect to propose compliance to an earlier amendment using the provisions of 14 CFR § 21.101(b). The exceptions in 14 CFR § 21.101(c) do not apply to categories of products defined in 14 CFR § 21.101(f).

**a. Special Classes Aircraft.** For special classes of aircraft, including the engines and propellers installed thereon (for example, gliders, airships), certificated in accordance with 14 CFR § 21.17(b), the applicable requirements will be portions of those other airworthiness requirements in 14 CFR Parts 23, 25, 27, 29, 31, 33, and 35 found by the Administrator to be appropriate for the aircraft and applicable to the specific type design, or such airworthiness criteria that the Administrator may find provide an equivalent level of safety to those Parts.

**b. Primary Category Aircraft.** For primary category aircraft certificated under 14 CFR § 21.24, the applicable airworthiness requirements are in 14 CFR Parts 23, 27, 31, 33, and 35, or such other requirements as the Administrator may find appropriate. These requirements must be applicable to the specific design and intended use of the aircraft and provide a level of safety acceptable to the Administrator.

**c. Restricted Category Aircraft.** For aircraft certificated in the restricted category under 14 CFR § 21.25(a)(1), the application of the latest regulations would not normally be considered to contribute materially to the level of safety or be practical for its intended use. However, if the regulations incorporated by reference in the type certificate do not provide an appropriate level of safety for its intended use, the application of a later regulation would be considered.

**(1)** Features of the changed product that are “novel” or “unusual” to the original certificated restricted category product may be assessed against a later requirement that addresses the feature. In this case, the requirements in effect at the time of the existing restricted category type certificate may be viewed as a starting point, with subsequent amendments being examined, if necessary, to arrive at a requirement that provides an appropriate level of safety.

**(2)** For the installation of turbo propeller engines instead of reciprocating engines, either in a restricted category aircraft that was originally certificated based on satisfactory military service experience or in a restricted category aircraft for which the original certification basis did not contain regulations for turbine engine installations, later amendments must be used to provide an appropriate level of safety for its intended operation.

**d. Military aircraft designs.** Aircraft type certificated in the restricted category under 14 CFR § 21.25(a)(2) are accepted on the basis of the U.S. military use instead of showing compliance with airworthiness standards in 14 CFR Chapter 1. Many of these aircraft were not certificated to a specific set of airworthiness standards, therefore, an appropriate equivalent civilian certification basis could be determined using the table in 14 CFR § 21.27 for surplus military aircraft. Title 14 CFR § 21.101(f) requires the application of the latest amendments to significant changes to these products. However, since the latest amendments may not be appropriate for the aircraft's intended use, earlier regulations are acceptable. They may not predate the equivalent certification basis. If these regulations do not include design standards applicable to the change, later regulations appropriate to the product category will be applied. The goal is to maintain a level of safety at least equivalent to the original design and appropriate for the aircraft's intended use.

**e. Surplus military aircraft.** Aircraft type certificated under 14 CFR § 21.27 are entitled to a TC in the normal, utility, acrobatic, commuter, or transport category. These aircraft were designed and constructed in the United States, accepted for operational use, and declared surplus by the U.S. Armed Forces. These aircraft may be counterparts, and are considered equivalent, to the previously civil certificated aircraft. Product changes or modifications to these aircraft are certificated in the same manner as their civil counterparts.

**f. Limited category aircraft.** Limited category aircraft are surplus military aircraft, mostly from World War II, that were type certificated under Part 9 of the Civil Air Regulations for use in other than air transport. These aircraft were not intended to carry persons or property for hire, and normally were accepted on the basis of their previous military qualifications acceptance and service record. However, a change to these aircraft not supported by the military service history must comply with appropriate airworthiness standards. The appropriate standard should be determined with recognition that the aircraft has not been type certificated to a civil aircraft airworthiness standard. Therefore, a change to an aircraft of this type may not realize a safety benefit by complying with later airworthiness standards.

**13. DOCUMENTATION.** All changes that result in a revision to the product's certification basis must be reflected on the Type Certification Data Sheet. Similarly, the certification basis must be noted on all STCs.

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## **Appendix 1. Classification of Changes**

Appendix 1 includes tables of typical changes for small aircraft (Figure 1), transport aircraft (Figure 2), rotorcraft (Figure 3), and engines/propellers (Figure 4) that meet the definition of a significant change or substantial change for each product line. The Appendix also includes typical changes that do not achieve the significant level.

(a) The examples in the tables were developed using data from Administrator files and included industry review and input. They clearly are changes that we have seen in the past and will likely continue to see in the future. The Administrator has made the determination, based on applying the automatic criteria, that these changes are significant or not significant.

**NOTE:** The small airplane table (Figure 1) was developed working with industry representatives who identified 500+ distinct, typical changes for these airplanes. These examples were validated by a comprehensive review of Part 23 Certification Project Notifications (CPNs) for 1998, 1999, 2000, and 2001 (approximately 1,800 cases). The examples in Appendix 1 reflect many of the significant, product level changes we would expect to see. The transport airplane table (Figure 2) was developed, in part, by reviewing all STC/ATC Certification Project Notifications for 2000 and 2001. The 3,000+ change projects for these two years represented 324 distinct major change projects the Transport Airplane Directorate reviewed over the two-year period. Part 25 industry representatives further reviewed and validated the examples.

(1) The rotorcraft table (Figure 3) was developed by a working group of Administrator and industry representatives. They were validated by the Rotorcraft Directorate review of recent applications for product changes and reflect changes the rotorcraft community typically makes.

(2) The Engine and Propeller Directorate developed the engine and propeller table (Figure 4), and representatives of the engine manufacturers reviewed and validated it. They reflect the types of changes the engine and propeller industry would typically make to their products.

(b) The columns “Change to General Configuration,” “Change to Principles of Construction,” and “Assumptions of Certification” reflect the automatic criteria of 14 CFR §§ 21.101(b)(1)(i) and (ii). The “Notes” column provides typical rationales that are considered in evaluating the designation of the criteria.

(c) The tables can be used:

(1) To classify a proposed change that is listed in the table, or

**(2)** With the three automatic criteria, to understand the logic used in the table to help classify a proposed change not in the table.

**(d)** The classification may change due to cumulative effects and/or combinations of individual changes.



**Figure 1. Examples of Changes for Small Airplanes (Part 23)**

The following tables of substantial and significant changes are based on 10 years of international experience, and were added/revised by revisitation of the Directorates & U.S. Industry.

The following are examples of SUBSTANTIAL changes:

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Change in wing location (tandem, forward, canard, high/low)	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Fixed wing to tilt wing	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Increase in the number of engines from one to two	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Replacement of piston or turbo-prop engines with turbojet or turbofan engines	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Change in engine configuration (tractor/pusher)	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of SUBSTANTIAL changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Change from an all metal airplane to all composite primary structure (fuselage, wing, empennage)	NA	NA	NA	
Increase from subsonic to supersonic flight regime	NA	NA	NA	

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued**

The following are examples of SIGNIFICANT changes:

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated?  14 CFR § 21.101(b)(1)(ii)	Notes
Conventional tail to T-tail or Y-tail, or vice versa	Yes	No	Yes	Change in general configuration. Requires extensive structural, flying qualities and performance reinvestigation. Requires new AFM to address performance and flight characteristics.
Changes in wing configuration, addition of tail strakes or change in dihedral, or changes in wing span, flap or aileron span, angle of incidence of the tail, addition of winglets, or wing sweep of more than 10%	Yes	No	Yes	Change in general configuration. Likely requires extensive changes to wing structure. Requires new AFM to address performance and flight characteristics. <b>NOTE:</b> Small changes to wingtip are not significant changes. See table for not significant changes.
Tricycle/tailwheel undercarriage change or addition of floats	Yes	No	No	Change in general configuration. Likely, at airplane level, general configuration and certification assumptions remain valid.
Increase in seating capacity resulting in a different certification category (e.g., from normal to commuter category) where configuration or principles of construction changes or assumptions do not remain valid.	Yes	Yes	Yes	Change in general configuration. Change in principles of construction. Requires extensive construction reassessment. Change in certification assumptions. Requires new AFM and pilot type rating.

**Examples of SIGNIFICANT changes, continued:**

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated?  14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Passenger to freighter configuration conversion which involves the introduction of a cargo door or an increase in floor loading of more than 20%, or provision for carriage of passengers and freight together	Yes	No	Yes	Change in general configuration affecting load paths, aeroelastic characteristics, aircraft related systems, etc. Change in design assumptions.
A fuselage stretch would be considered significant if it would invalidate the existing substantiation, or would change the primary structure, aerodynamics, or operating envelope sufficiently to invalidate the assumptions of certification.	Yes	No	Yes	Likely extensive changes to fuselage structure, aerodynamics, aircraft systems performance, and operating envelope. Requires new AFM to address performance and flight characteristics.
Replace reciprocating engines with the same number of turbo-propeller engines where the operating envelope is expanded.	No	No	Yes	Invalidates certification assumptions. Requires new AFM to address performance and flight characteristics.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Addition of a turbo-charger that changes the power envelope, operating range, or limitations appreciably	No	No	Yes	Invalidates certification assumptions due to changes in operating envelope and limitations.  Requires new AFM to address performance and flight characteristics.
The replacement of an engine of higher rated power or increase thrust would be considered significant if it would invalidate the existing substantiation, or would change the primary structure, aerodynamics, or operating envelope sufficiently to invalidate the assumptions of certification.	No	Yes	Yes	Invalidates certification assumptions. Requires new AFM to address performance and flight characteristics. Likely changes to primary structure. Requires extensive construction reinvestigation.
A change in the type of material, such as composites in place of metal, or one composite fiber material system with another (e.g., carbon for fiberglass), for primary structure would normally be assessed as a significant change.	No	Yes	Yes	Change in principles of construction and design from conventional practices.  Likely change in design/certification assumptions.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Change involving appreciable increase in design speeds $V_d$ , $V_{mo}$ , $V_c$ , or $V_a$	No	No	Yes	Certification assumptions invalidated. Requires new AFM to address performance and flight characteristics.
STOL kit	No	No	Yes	Certification assumptions invalidated. Requires new AFM to address performance and flight characteristics.
A change in the rated power or thrust is likely to be regarded as significant if the design speeds are thereby changed so that compliance needs to be rejustified with a majority of requirements.	No	No	Yes	Certification assumptions invalidated. Requires new AFM to address performance and flight characteristics.
Fuel state: such as compressed gaseous fuels, or fuel cells. This could completely alter the fuel storage and handling systems and possibly affect the airplane structure.	No	No	Yes	Changes in design/certification assumptions. Extensive alteration of fuel storage and handling systems.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
A design change that alters the aircraft flight characteristics or performance from the type design would normally be significant if it appreciably changes the kinematics or dynamics of the airplane.	No	No	Yes	Certification assumptions invalidated.  Requires new AFM to address performance and flight characteristics.
Weight increase that places the aircraft into the commuter category (i.e., above 12,500 lbs)	No	No	Yes	Certification assumptions invalidated. Requires new AFM.
A change in the flight control concept for an aircraft, for example, to fly by wire (FBW) and side-stick control, or a change from hydraulic to electronically actuated flight controls, would in isolation normally be regarded as a significant change.	No	No	Yes	Changes in design and certification assumptions. Requires extensive systems architecture and integration reinvestigation. Requires new AFM.
Addition of cabin pressurization	No	Yes	Yes	Extensive airframe changes effecting load paths, fatigue evaluation, aero elastic characteristics, etc. Requires extensive construction reinvestigation. Invalidates design assumptions.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Changes in types and number of emergency exits or an increase in passenger capacity in excess of maximum passenger capacity demonstrated for the aircraft type.	No	No	Yes	Emergency egress requirements exceed those previously substantiated. Invalidates assumptions of certification.
A change in the required number of flight crew, which necessitates a complete cockpit rearrangement, and/or an increase in pilot workload would be a significant change.	No	No	Yes	Extensive changes to avionics and aircraft systems. Invalidates certification assumptions. Requires new AFM.
An appreciable expansion of an aircraft's operating envelope or operating capability would normally be a significant change, e.g., an increase in maximum altitude limitation, approval for flight in known icing conditions, an increase in airspeed limitations	No	No	Yes	Invalidates certification assumptions. Requires new AFM to address performance and flight characteristics.



**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
A major flight deck upgrade	No	No	Yes	Extensive changes to avionics and electrical systems design.  Invalidates certification assumptions.  Extensive reassessments of systems integration, flight crew workload, and human factors evaluation are required. Requires new AFM.
Introduction of autoland	No	No	Yes	Invalidates original design assumptions.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued**

The following are examples of NOT SIGNIFICANT changes:

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated?  14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Addition of wingtip modifications (not winglets)	No	No	No	A major change to the airplane. Likely the original general configuration, principles of construction, and certification assumptions remain valid.
Installation of skis or wheel skis	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
FLIR or surveillance camera installation	No	No	No	Additional flight or structural evaluation may be necessary, but the change does not alter basic airplane certification.
Litter, berth and cargo tie down device installation	No	No	No	Not an airplane level change.
Increased tire size, including tundra tires	No	No	No	Not an airplane level change.
Replacement of one propeller type with another (irrespective of increase in number of blades)	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of NOT SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration? 14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction? 14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Addition of a turbo-charger that does not change the power envelope, operating range, or limitations (e.g., a turbo-normalized engine, where the additional power is used to enhance high altitude or hot day performance).	No	No	No	Not an airplane level change.
Replacement of petrol engine with a diesel engine or approximately the same horsepower.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Substitution of one method of bonding for another (e.g., change in type of adhesive)	No	No	No	Not an airplane level change.
Substitution of one type of metal for another	No	No	No	Not an airplane level change.
Any change in construction or fastening not involving primary structure	No	No	No	Not an airplane level change.
A new fabric type for fabric skinned aircraft	No	No	No	Not an airplane level change.
Increase in flap speed or undercarriage limit speed	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of NOT SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Structural strength increases	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
IFR upgrades involving installation of components (where the original certification does not indicate that the airplane is not suitable as an IFR platform, e.g., special handling concerns).	No	No	No	Not an airplane level change.
Fuel lines, where engine horsepower is increased but fuel flow is not increased beyond the certificated maximum amount.	No	No	No	Not an airplane level change.
Fuel tanks, where fuel is changed from gasoline to diesel fuel and tank support loads are small enough that an extrapolation from the previous analysis would be valid. Chemical compatibility would have to be substantiated.	No	No	No	Not an airplane level change.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of NOT SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Limited changes in a pressurization system, e.g., number of outflow valves, type of controller, or size of pressurized compartment, but the system must be resubstantiated if the original test data are invalidated.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Install a quieter exhaust system	No	No	No	Not an airplane level change.
Changes in engine cooling or cowling	No	No	No	Not an airplane level change.
Fuel type: AvGas to Diesel/Jet A, AvGas to Ethanol/Methanol. Changing to multiple fuel systems containing fuel types (other than systems used for starting): such as AvGas/Ethanol, or Jet A/AutoGas (turbine). Unrestricted mixtures in one fuel system of different fuel types: such as AvGas/Diesel or Jet A/Ethanol.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of NOT SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?</b>  <b>14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?</b>  <b>14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated?</b>  <b>14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Fuels of substantially the same type: such as AvGas to AutoGas, AvGas (80/87) to AvGas (100LL), ethanol to isopropyl alcohol, Jet B to Jet A (although Jet A to Jet B may be considered significant due to the fact that Jet B is considered potentially more explosive).	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Fuels that specify different levels of “conventional” fuel additives that do not change the primary fuel type. Different additive levels (controlled) of MTBE, ETBE, ethanol, amines, etc., in AvGas would not be considered a significant change.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
A change to the maximum take-off weight of less than 5%, unless assumptions made in justification of the design are thereby invalidated.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of NOT SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
An additional aileron tab (e.g., on the other wing)	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Larger diameter flight control cables with no change in routing, or other system design	No	No	No	Not an airplane level change.
Autopilot installation (for IFR use, where the original certification does not indicate that the airplane is not suitable as an IFR platform)	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Increased battery capacity or relocate battery	No	No	No	Not an airplane level change.
Replace generator with alternator	No	No	No	Not an airplane level change.
Additional lighting (e.g., navigation lights, strobes)	No	No	No	Not an airplane level change.
Higher capacity brake assemblies	No	No	No	Not an airplane level change.
Increase in fuel tank capacity	No	No	No	Not an airplane level change.
Addition of an oxygen system	No	No	No	Not an airplane level change.
Relocation of a galley	No	No	No	Not an airplane level change.

**Figure 1. Examples of Changes for Small Airplanes (Part 23), continued****Examples of NOT SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Passenger to freight (only) conversion with no change to basic fuselage structure.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.  Requires certification substantiation applicable to freighter requirements.
Installation of new seat belt or shoulder harness	No	No	No	Not an airplane level change.
A small increase in cg range	No	No	No	At airplane level, no change in general configuration, principles of construction, and certification assumptions.
APU installation that is not flight essential	No	No	No	Although a major change to the airplane level, likely the original general configuration, principles of construction, and certification assumptions remain valid.  Requires certification substantiation applicable to APU installation requirements.
An alternative autopilot	No	No	No	Not an airplane level change.
Addition of Class B Terrain Awareness and Warning Systems (TAWS)	No	No	No	Not an airplane level change.



**Figure 2. Examples of Changes for Transport Airplanes (Part 25)**

The following are examples of SUBSTANTIAL changes:

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Change in the number or location of engines, e.g., four to two wing-mounted engines or two wing-mounted to two body-mounted engines.	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Change from a high-wing to low-wing configuration.	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Change from an all metal airplane to all composite primary structure (fuselage, wing, empennage).	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

**Figure 2. Examples of Changes for Transport Airplanes (Part 25), continued**

The following are examples of SIGNIFICANT changes:

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Derivative model, e.g., increased passenger payload, freighter version or complete update of a certificated airplane.	Yes	Yes	Yes	Multiple changes packaged into a new model. Increased payload or new freighter would change the general configuration and assumptions. Updated airplane could change principles of construction.
Reduction in the number of flight crew (In conjunction with flight deck update).	Yes	No	No	Extensive changes to avionics and aircraft systems. Impact to crew workload and human factors, pilot type rating.
Modify an airplane for flight in known icing conditions by adding systems for ice detection and elimination.	Yes	No	Yes	New aircraft operating envelope. Requires major new systems installation and aircraft evaluation. Operating envelope changed.
Conversion – passenger or combo to all freighter, including cargo door, redesign floor structure and 9g net or rigid barrier	Yes	No	Yes	Extensive airframe changes affecting load paths, aeroelastic characteristics, aircraft related systems for fire protection, etc. Design assumptions changed from passenger to freighter.
Change to pressurized cabin, including the introduction of a pressurization system.	No	No	Yes	Essentially a recertification of airframe and systems associated with operating envelope change.
Addition of leading edge slats	Yes	No	No	Requires extensive changes to wing structure, adds aircraft systems, and requires a new airplane flight manual to address performance and flight characteristics.

**Figure 2. Examples of Changes for Transport Airplanes (Part 25), continued****Examples of SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated?  14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Fuselage length change – lengthen or shorten fuselage	Yes	No	No	Only when it requires extensive changes to fuselage structure, affects aircraft systems, and requires a new airplane flight manual to address performance and flight characteristics.
Extensive structural airframe modification, such as installation of a large telescope with large opening in fuselage.	Yes	No	No	Requires extensive changes to fuselage structure, affects aircraft systems, and requires a new airplane flight manual to address performance and flight characteristics.
Changing the number of axles or number of landing gear done in context with a product change that involves changing the airplane gross weight.	Yes	No	No	Requires extensive changes to aircraft structure, affects aircraft systems, and requires AFM changes.
Primary structure changes from metallic material to composite material.	No	Yes	No	Change in principles of construction and design from conventional practices.
Typically, an increase in design weight of more than 10%.	No	No	Yes	Requires extensive resubstantiation of aircraft structure, aircraft performance and flying qualities and associated systems.

**Figure 2. Examples of Changes for Transport Airplanes (Part 25), continued****Examples of SIGNIFICANT changes, continued:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Wing changes in span, sweep, and tip designs or wing chord.  (NOTE: Potentially substantial if it is a change from a high wing to a low wing, or a new wing.)	Yes	No	No	When it requires extensive changes to wing structure, adds aircraft systems, and requires a new airplane flight manual to address performance and flight characteristics.
Change in type or number of emergency exits or an increase in the number of passengers demonstrated.	No	No	Yes	The new emergency egress requirements exceed those previously substantiated.
Comprehensive flight deck upgrade.	No	No	Yes	Affects avionics and electrical systems integration and architecture concepts and philosophies. This drives a reassessment of flight crew workload and other human factors issues, and requires a re-evaluation of the original design assumptions used for the cockpit.
Change in primary flight controls to fly by wire (FBW) system.  (Some airplanes have some degree of FBW. Achieving full FBW may be a not significant change on some airplanes.)	Yes	No	Yes	When the degree of change is so extensive that it affects basic aircraft systems integration and architecture concepts and philosophies. This drives a complete reassessment of flight crew workload, handling qualities, and performance evaluation, which are different from the original design assumptions.

**Figure 2. Examples of Changes for Transport Airplanes (Part 25), continued****Examples of SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Replace reciprocating with turbo-propeller engines.	Yes	No	No	Requires extensive changes to airframe structure, addition of aircraft systems, and new airplane flight manual to address performance and flight characteristics.
Typically a thrust increase of more than 10%.	No	No	Yes	Requires resubstantiation of powerplant installation, and has a marked affect on aircraft performance and flying qualities.
Initial installation of an autoland system.	No	No	Yes	Baseline airplane not designed for autoland operation, potential crew workload and systems compatibility issues.
Installation of a new fuel tank, (horizontal stabilizer tank or auxiliary fuel tank in the fuselage outside the wing in conjunction with increased maximum takeoff weight and takeoff thrust)	No	No	Yes	Requires changes to airframe, systems and AFM. Results in performance changes.
Main deck cargo door installation.	Yes	No	No	Redistribution of internal loads, change in aeroelastic characteristics, system changes.

**Figure 2. Examples of Changes for Transport Airplanes (Part 25), continued****Examples of SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Conversion from a passenger floor to a cargo floor and installation of a cargo handling system.	No	No	Yes	Completely new floor loading and design. Redistribution of internal loads, change in cabin safety requirements, system changes.
Initial installation of an APU essential for aircraft flight operation.	No	No	Yes	Changes emergency electrical power requirements, change in flight manual and operating characteristics.

**Figure 2. Examples of Changes for Transport Airplanes (Part 25), continued**

The following are examples of NOT SIGNIFICANT changes:

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Alternate engine installation or hush kit at same position.	No	No	No	Typically it is not significant so long as there is not more than a 10% increase in thrust or a change in the principles of propulsion.
Fuselage length changes – lengthen or shorten fuselage.	No	No	No	A small change in fuselage length due to refairing the aft body or radome for cruise performance reasons, where such changes do not require extensive structural, systems, or AFM changes.
Refairing of wing tip caps (for lights, fuel dump pipes) and addition of splitter plates to the trailing edge thickness of the cruise airfoil.	No	No	No	Does not require extensive structural, AFM, or systems changes.
Additional power used to enhance high altitude or hot day performance.	No	No	No	Usually no change in basic operating envelope. Existing certification data can be extrapolated. Could be significant product change if the additional power is provided by installation of a rocket motor or additional, on demand engine due to changes in certification assumptions.

**Figure 2. Examples of Changes for Transport Airplanes (Part 25), continued****Examples of NOT SIGNIFICANT changes, continued:**

Description of change	Is there a change to the general configuration? 14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction? 14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
General avionics changes.	No	No	No	These modifications are generally adaptive* in nature, and do not change the original certification assumptions, alter basic cockpit design architecture concepts and philosophies, and do not have a major impact on crew workload or man/machine.  *Adaptive means the change adapts to the existing airplane buses, power, structure, etc.
Initial installation of an autopilot system.	No	No	No	Modification is generally adaptive in nature, with no change to original certification assumptions.
Integrated modular avionics.	No	No	No	The basic functionality of the systems is unchanged. No change from analog to digital.
Installation or rearrangement of an interior in an aircraft.	No	No	No	Special conditions could be required for new and novel features
Change from assembled primary structure to monolithic or integrally machined structure.	No	No	No	Method of construction must be well understood.
Modification to ice protection systems.	No	No	No	Recertification required, but certification basis is adequate.
Brakes: design or material change, e.g., steel to carbon.	No	No	No	Recertification required, but certification basis is adequate.



**Figure 2. Examples of Changes for Transport Airplanes (Part 25), continued****Examples of NOT SIGNIFICANT changes, continued:**

Description of change	Is there a change to the general configuration? 14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction? 14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Redesign floor structure.	No	No	No	By itself, not a significant product change. It could be significant if part of a cargo converted passenger airplane.
Novel or unusual method of construction of a component.	No	No	No	The component change does not rise to the product level.  Special conditions could be required if there are no existing regulations that adequately address these features.
Initial installation of a non-essential APU.	No	No		A stand-alone initial APU installation on an airplane originally designed to use ground/airport supplied electricity, and air-conditioning. In this case, the APU would be an option to be independent of airport power.

**Figure 3. Examples of Changes for Rotorcraft (Parts 27 and 29)**

The following are examples of SUBSTANTIAL changes:

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Change from the number and or configuration of rotors (e.g., main & tail rotor system to two main rotors.	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Change from an all metal rotorcraft to all composite rotorcraft.	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

**Figure 3. Examples of Changes for Rotorcraft (Parts 27 and 29), continued**

The following are examples of SIGNIFICANT changes:

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Comprehensive flight deck upgrade.	No	No	Yes	The degree of change is so extensive that it affects basic avionics and electrical systems integration and architecture concepts and philosophies. This drives a complete reassessment of flight crew workload and other human factor issues, and requires a re-evaluation of the original design assumptions used for the cockpit.
Certification for flight into known icing conditions.	No	No	Yes	
(Fixed) flying controls from mechanical to fly by wire.	Yes	Yes	Yes	
Addition of an engine; e.g., from single to twin or reduction of the number of engines; e.g., from twin to single.	Yes	No	Yes	May be a substantial change depending upon project details.
A fuselage modification that changes the primary structure, aerodynamics, and operating envelope sufficiently to invalidate the certification assumptions.	Yes	No	Yes	

**Figure 3. Examples of Changes for Rotorcraft (Parts 27 and 29), continued****Examples of SIGNIFICANT changes, continued:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated?  14 CFR § 21.101(b)(1)(ii)	Notes
Application of an approved primary structure to a different approved model (e.g., installation on a former model of the main rotor approved on a new model that results in increase performance).	No	Yes	Yes	
Extensive primary structure changes from metallic material to composite material.	No	Yes	Yes	Change in principles of construction and assumptions used for certification for the product level change. Changes of a few individual elements from metal to composite are not typically considered a significant change.
Emergency Medical Service (EMS) Configuration with primary structural changes sufficient to invalidate the certification assumptions.	No	No	Yes	Many EMS configurations will not be classified as significant. Modifications made for EMS are typically internal, and the general external configuration is normally not affected. These changes should not automatically be classified as significant.
Skid landing gear to wheel landing gear or wheel landing to skid.	Yes	No	Yes	If the rotorcraft is such that the skid or wheel configuration is inherent in the basic certification design, the change may be not significant.

**Figure 3. Examples of Changes for Rotorcraft (Parts 27 and 29), continued****Examples of SIGNIFICANT changes, continued:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Change of the number of rotor blades.	Yes	No	No	Thee addition/deletion of rotorblades may not be significant, provided the remainder of the basic propulsion system remains essentially unchanged.
Change tail anti-torque device (e.g., tail rotor, ducted fan or other technology).	Yes	Yes	No	

**Figure 3. Examples of Changes for Rotorcraft (Parts 27 and 29), continued**

The following are examples of NOT SIGNIFICANT changes:

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Emergency floats	No	No	No	Must comply with the specific applicable requirements for emergency floats. This installation, in itself, does not change the rotorcraft configuration, overall performance, or operational capability. Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, or flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type certificated product level.
FLIR or surveillance camera installation	No	No	No	Additional flight or structural evaluation may be necessary but the change does not alter the basic rotorcraft certification.
Helicopter Terrain Awareness Warning System (HTAWS) for operational credit	No	No	No	Certificated per rotorcraft HTAWS AC guidance material.
Health Usage Monitoring System (HUMS) for Maintenance Credit	No	No	No	Certificated per rotorcraft HUMS AC guidance material.

**Figure 3. Examples of Changes for Rotorcraft (Parts 27 and 29), continued****Examples of NOT SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Expanded limitations with minimal or no design changes, following further tests/justifications or different mix of limitations (CG limits, oil temperatures, altitude, minimum/maximum weight, minimum/max external temperatures, speed, ratings structure)	No	No	No	Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, or flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type certificated product level.
Installation of a new engine type, equivalent to the former one; leaving aircraft installation and limitations substantially unchanged	No	No	No	Refer to AC 27-1 or AC 29-2 for guidance
Windscreen installation	No	No	No	Does not change the rotorcraft overall product configuration.

**Figure 3. Examples of Changes for Rotorcraft (Parts 27 and 29), continued****Examples of NOT SIGNIFICANT changes, continued:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Snow skis, "Bear Paws"	No	No	No	Must comply with specific requirements associated with the change. Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, or flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type certificated product level.
External cargo hoist	No	No	No	Must comply with the specific applicable requirements for external loads. This installation, in itself, does not change the rotorcraft configuration, overall performance, or operational capability. Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, or flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type certificated product level.



**Figure 3. Examples of Changes for Rotorcraft (Parts 27 and 29), continued****Examples of NOT SIGNIFICANT changes, continued:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
IFR upgrades involving installation of components (where the original certification does not indicate that the rotorcraft is not suitable as an IFR platform, e.g., special handling concerns).	No	No	No	Not a rotorcraft level change.
An upgrade to CAT A certification approval	No	No	No	Typically these are engine and drive systems rating changes appropriate for CAT A and rotorcraft performance requirements. These changes do not typically invalidate the certification assumptions, or change the general configuration of principles of construction.
Reducing the number of pilots for IFR from 2 to 1	No	No	No	May be significant if there are extensive equipment and design changes such that the certification assumptions are invalidated or the general configuration of the rotorcraft is changed.

**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35)**

The following are examples of SIGNIFICANT changes:

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
<b>Turbine Engines</b>				
Traditional turbofan to geared-fan engine	Yes	No	Yes	This change would affect the engine in terms of foreign object ingestion, etc.  Note that this change is most likely substantial under 21.19
Low bypass ratio engine to high bypass ratio engine with an increased inlet area	Yes	No	Yes	Change in general configuration  Likely change in model designation  Not interchangeable  Assumptions for certification may no longer be valid in terms of ingestion, icing, etc.  Note that this change is most likely substantial under 21.19
Turbojet to Turbofan	Yes	No	Yes	Change in general configuration  Likely change in model designation  Not interchangeable  Assumptions for certification may no longer be valid lifting, ingestion, icing, blade out criteria, etc.  Note that this change is most likely substantial under 21.19

**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35), continued****The following are examples of SIGNIFICANT changes:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Turbo-shaft to turbo-propeller	Yes	No	Yes	Change in configuration such as an additional gearbox  Change in model designation  Change in mission profile  Assumptions for certification may no longer be valid in terms of flight envelope, ratings, etc  Note that this change is most likely substantial under 21.19
Conventional ducted fan to unducted fan	Yes	Yes	Yes	Change in configuration  Change in type  Not interchangeable  Assumptions for certification may no longer be valid  Note that this change is most likely substantial under 21.19
Conventional engine for subsonic operation to afterburning engine for supersonic operation	Yes	Yes	Yes	Change in configuration  Change in type  Not interchangeable  Assumptions for certification may no longer be valid  Change in operating envelope  Note that this change is most likely substantial under 21.19

**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35), continued****The following are examples of SIGNIFICANT changes:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Increase/decrease in the number of compressor/turbine stages with resultant change in approved limitations* (* exclude life limits)	No	No	Yes	Change is associated with other changes that would affect the rating of the engine and have affected the dynamic behavior, in terms of backbone bending, torque spike effects on casing, surge and stall characteristics, etc.
New design fan blade and fan hub, or a bladed fan disk to a blisk, or a fan diameter change, that could not be retrofitted.	Yes	No	Yes	Likely change in model designation  Change is associated with other changes that would affect engine thrust/power limitations and have affected the dynamic behavior of the engine in terms of backbone bending, torque spike effects on casing, foreign object ingestion behavior, burst model protection for the aircraft. If there is a diameter change, installation will be also affected.

**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35), continued****The following are examples of SIGNIFICANT changes:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Hydro-Mechanical control to FADEC/EEC without hydro mechanical backup	Yes	No	Yes	Change in engine control configuration Likely change in model designation Not interchangeable Likely fundamental change to engine operation Assumptions used for certification are no longer valid or were not addressed in the original certification, i.e., HIRF and Lightning Protection, Fault Tolerance, Software Certification and other aspects associated with FADEC/EEC's systems.
A change in the containment case from hard-wall to composite construction or vice versa, that could not be retrofitted without additional major changes to the engine or restricting the initial limitations or restrictions in the initial installation manual	No	Yes	Yes	Change in methods of construction that have affected inherent strength, backbone bending, blade to case clearance retention, containment wave effect on installation, effect on burst model, torque spike effects.
Replacement of the gas generator (core, compressor/combustor/turbine) with a different one that is associated with changes in approved limitations* *exclude life limits	No	No	Yes	Change is associated with other changes that would affect engine thrust/power and have affected the dynamic behavior of the engine Assumptions used for certification may no longer be valid

**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35), continued**

The following are examples of SIGNIFICANT changes:

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
<b>Piston Engines</b>				
Convert from Mechanical to Electronic Control System	Yes	Yes	No	Change in engine configuration: Installation interface of engine changed  Changes to principles of construction: Digital controllers and sensors require new construction techniques and environmental testing
Add Turbocharger that increases performance and changes in overall product	Yes	No	Yes	Change in general configuration: Installation interface of engine changed (exhaust system)  Certification assumptions invalidated: Change in operating envelope and performance.
Convert from air-cooled cylinders to liquid cooled cylinders	Yes	No	Yes	Change to general configuration: Installation interface of engine changed (cooling lines from radiator, change to cooling baffles)  Certification assumptions invalidated: Change in operating envelope and engine temperature requirements
Convert from spark-ignition to compression-ignition	Yes	No	Yes	Change in general configuration: Installation interface of engine changed (no mixture lever)  Certification assumptions invalidated: Change in operating envelope and performance.

**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35), continued****The following are examples of SIGNIFICANT changes:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
<b>Propellers</b>				
Introduction of a different principle of blade retention	Yes	Yes	No	Change in propeller configuration  Likely change in model designation  Propeller's operating characteristics and inherent strength require re-evaluation.

**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35), continued**

**The following are examples of NOT SIGNIFICANT changes:**

Description of change	Is there a change to the general configuration ?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
<b>Turbine Engines</b>				
Change in the material from one type of metal to another type of metal of a compressor drum	No	No	No	No change in performance No likely change in model designation Assumptions are still valid
Increase/decrease in the number of compressor/turbine stages without resultant change in performance envelope	No	No	No	No change in performance Model designation may or may not change Assumptions are still valid
New components internal to the FADEC/EEC the introduction of which does not change the function of the system	No	No	No	No change in configuration Retrofitable Assumptions used for certification are still valid Possible changes in principles of construction are insignificant
Software changes	No	No	No	
Rub-strip design changes	No	No	No	Component Level Change
A new combustor that does not change the approved limitations, or dynamic behavior* *exclude life limits	No	No	No	Component Level Change
Bearing changes	No	No	No	Component Level Change



**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35), continued****Examples of NOT SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration ?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
New blade designs with similar material that can be retrofitted	No	No	No	Component Level Change
Fan blade redesign that can be retrofitted	No	No	No	Component Level Change
Oil tank redesign	No	No	No	Component Level Change
Change from one hydro-mechanical control to another hydro-mechanical control	No	No	No	Component Level Change
Change to limits on life limited components	No	No	No	Component Level Change
Changes to limits on exhaust gas temperature	No	No	No	
Changes in certification maintenance requirements (CMR) with no configuration changes	No	No	No	
Bump ratings within the product's physical capabilities that may be enhanced with gas path changes such as blade restaggered, cooling hole patterns, blade coating changes, etc.	No	No	No	

**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35), continued**  
**Examples of NOT SIGNIFICANT changes, continued:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
A change in principal physical properties and mechanics of load transfer of a material of primary structure or highly loaded components. For example, change from traditional metal to either an exotic alloy or a composite material on a highly loaded component	No	No	No	Component Level Change
<b>Piston Engine</b>				
A change in principal physical properties and mechanics of load transfer of a material of primary structure or highly loaded components. For example, change from traditional metal to either an exotic alloy or a composite material on a highly loaded component	No	No	No	Component Level Change
New or redesigned cylinder head, or valves, or pistons	No	No	No	
Changes in crankshaft	No	No	No	Component Level Change
Changes in crankcase	No	No	No	Component Level Change
Changes in carburetor	No	No	No	Component Level Change

**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35), continued****Examples of NOT SIGNIFICANT changes, continued:**

<b>Description of change</b>	<b>Is there a change to the general configuration ?  14 CFR § 21.101(b)(1)(i)</b>	<b>Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)</b>	<b>Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)</b>	<b>Notes</b>
Changes in mechanical fuel injection system	No	No	No	
Changes in mechanical fuel injection pump	No	No	No	Component Level Change
Engine model change to accommodate new airplane installation. No change in principles of operation of major subsystems; no significant expansion in power or operating envelopes or in limitations	No	No	No	
No change in basic principles of operation, or a simple mechanical change. For example, change from dual magneto to two single magnetos on a model	No	No	No	
Subsystem change produces no changes in base engine input parameters, and previous analysis can be reliably extended. For example, a change in turbocharger where induction system inlet conditions remain unchanged, or if changed, the effects can be reliably extrapolated	No	No	No	

**Figure 4. Examples of Changes for Engines and Propellers (Parts 33 and 35), continued**  
**Examples of NOT SIGNIFICANT changes, continued:**

Description of change	Is there a change to the general configuration?  14 CFR § 21.101(b)(1)(i)	Is there a change to the principles of construction?  14 CFR § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? 14 CFR § 21.101(b)(1)(ii)	Notes
Change in material of secondary structure or not highly loaded component. For example, a change from metal to composite material in a non-highly loaded component, such as an oil pan that is not used as a mount pad	No	No	No	Component Level Change
Change in material that retains the physical properties and mechanics of load transfer. For example, a change in trace elements in a metal casting for ease of pouring or to update to a newer or more readily available alloy with similar mechanical properties	No	No	No	Component Level Change
<b>Propellers</b>				
Change in the material of a blade bearing	No	No	No	Component Level Change
Change to a component in the control system	No	No	No	Component Level Change
Change to a propeller de-icer boot	No	No	No	Component Level Change

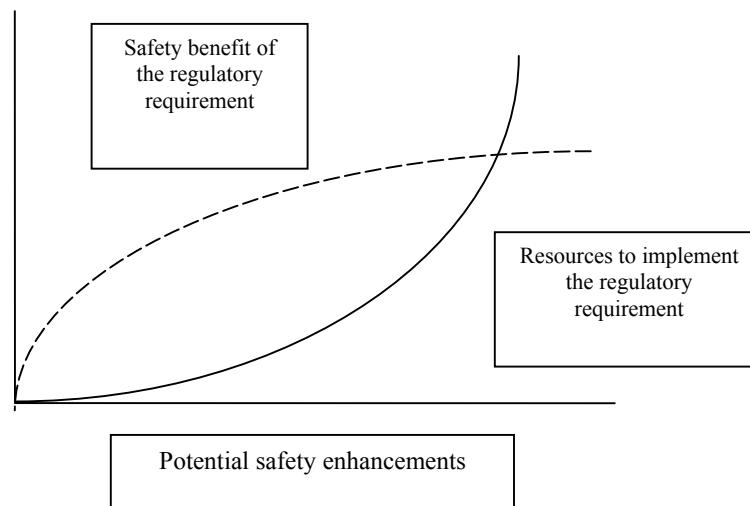
## Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product

### 1. INTRODUCTION.

a. The basic principal of enhancing the level of safety of changed aeronautical products is to apply the latest regulations for significant design changes, to the greatest extent practical. In certain cases, the cost of complying fully with a later regulation may not be commensurate with the small safety benefit achieved. It is recognized that the existing fleet and newly produced airplanes, engines and propellers are safe, and any unsafe condition is immediately addressed through the airworthiness directive process. These factors form the basis by which compliance with the latest standard may be considered impractical, thereby allowing compliance with an earlier regulation. This appendix gives one method of determining if compliance with a later regulation is impractical, however, this does not preclude the use of other methods for improving the safety of aeronautical products.

b. This AC recognizes that other procedures have been used for some products and have historically been accepted on a case-by-case basis. These procedures have not been fully harmonized and may not be acceptable for all products. It is envisaged that other methods will be developed and become part of future versions of this AC. Regardless of which method is used, the method must show that a proposed certification basis is resource-effective when it is able to achieve a positive safety benefit for the overall product.

c. In this regard, any method used must also encourage incorporating the safety enhancements that will have the most dramatic impact on the accident rate and recognize the effective use of limited resources. This important point is illustrated graphically in the accompanying figure. This figure notionally shows the interrelation between the total resources required for incorporating each potential safety enhancement with the corresponding net increase in safety benefit.



## **Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product, continued**

**d.** Typically one will find that there are proposals that can achieve a positive safety benefit that are resource effective. Conversely, there are proposals that may achieve a small safety benefit at the expense of a large amount of resources to implement. Clearly, there will be a point where a large percentage of the potential safety benefit can be achieved with a reasonable expenditure of resources. The focus of the methods used should be to determine the most appropriate set of safety-significant regulatory standards relative to the respective cost to reach this point.

**e.** This appendix provides procedural guidance for determining the practicality of applying a requirement at a particular amendment level to a changed product. This guidance can be used to evaluate the safety benefit and resource impact of implementing the latest airworthiness requirements in the certification basis of a changed product. The procedure is generic in nature and describes the steps and necessary inputs that any applicant can use on any project to develop a position.

**f.** The procedure is intended to be used, along with good engineering judgment, to evaluate the relative merits of a changed product complying with the latest regulations. It provides a means, but not the only means, for an applicant to present its position in regard to impracticality.

**g.** The certification basis for a change to a product will not be at an amendment level earlier than the existing certification basis. Therefore, when determining the impracticality of applying a requirement at the latest amendment level, only the increase in safety benefits and costs beyond compliance with the existing certification basis should be considered.

**h.** The following are steps to determine the impracticality of applying a requirement at a particular amendment level. The first step will be to identify the regulatory change being evaluated.

**(1) Step 1: Identify the Regulatory Change Being Evaluated.** In this step, document:

- (a)** The specific requirement (for example, 14 CFR § 25.365);
- (b)** The amendment level of the existing certification basis for the requirement; and
- (c)** The latest amendment level of the requirement.

**(2) Step 2: Identify the Specific Hazard that the Requirement Addresses.**

**(a)** Each requirement and subsequent amendments are intended to address a hazard or hazards. In this step the specific hazard(s) is/are identified. This

## **Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product, continued**

identification will allow for a comparison of the effectiveness of amendment levels of the regulation at addressing the hazard.

(b) In many cases the hazard and the cause of the hazard will be obvious. When the hazard and its related cause are not immediately obvious, it may be necessary to review the preamble of the regulation. It may also be helpful to discuss the hazard with the responsible FAA office.

### **(3) Step 3: Review the Consequences of the Hazard(s).**

(a) Once the hazard has been identified, it is possible to identify the types of consequences that may occur because of the presence of the hazard. More than one consequence can be attributed for the same hazard. Typical examples of consequences would include, but are not be limited to:

- (1) Incidents where only injuries occurred;
- (2) Accidents where less than 10% of the passengers died;
- (3) Accidents where 10% or more passengers died; and
- (4) Accidents where a total hull loss occurred.

(b) The preamble to the regulation may provide useful information regarding the consequences of the hazard the requirement is intended to address.

### **(4) Step 4: Identify the Historical and Predicted Frequency of Each Consequence.**

(a) Another source for determining impracticality is the historical record of the consequences of the hazard that led to a requirement or an amendment to a requirement. From these data, a frequency of occurrence for the hazard can be determined. It is important to recognize that the frequency of occurrence may be higher or lower in the future. Therefore, it also is necessary to predict the frequency of future occurrences.

(b) More than one consequence can be attributed for the same hazard. Therefore, when applicable, the combination of consequences and frequencies of those consequences should be considered together.

(c) The preamble of the regulation may provide useful information regarding the frequency of occurrence.

## **Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product, continued**

### **(5) Step 5: Determine How Effective Full Compliance with the Latest Amendment of the Requirement Would Be at Addressing the Hazard.**

(a) When each amendment is promulgated, it is usually expected that compliance with the requirement would be completely effective at addressing the associated hazard. It is expected that the hazard would be eliminated, avoided, or dealt with. However, in a limited number of situations, this may not be the case. It is also possible that earlier amendment levels may have addressed the hazard but were not completely effective. Therefore, in comparing the benefits of compliance with the existing certification basis to the latest amendment level, it is useful to estimate the effectiveness of both amendment levels in dealing with the hazard.

(b) It is recognized that the determination of levels of effectiveness is normally of a subjective nature. Therefore, prudence should be exercised when making these determinations. In all cases, it is necessary to document the assumptions and data that support the determination.

(c) The following five levels of effectiveness are provided as a guideline

**(1) Fully effective in all cases.** Compliance with the requirement eliminates the hazard or provides a means to avoid the hazard completely.

**(2) Considerable potential for eliminating or avoiding the hazard.** Compliance with the requirement eliminates the hazard or provides a means to avoid completely the hazard for all probable or likely cases, but it does not cover all situations or scenarios.

**(3) Adequately deals with the hazard.** Compliance with the requirement eliminates the hazard or provides a means to avoid the hazard completely in many cases. However, the hazard is not eliminated or avoided in all probable or likely cases. Usually this action only addresses a significant part of a larger or broader hazard.

**(4) Hazard only partly addressed.** In some cases compliance with the requirement partly eliminates the hazard or does not completely avoid the hazard. The hazard is not eliminated or avoided in all probable or likely cases. Usually this action only addresses part of a hazard.

**(5) Hazard only partly addressed but action has negative side effect.** Compliance with the requirement does not eliminate or avoid the hazard or may have negative safety side effects. The action is of questionable benefit.

### **(6) Step 6: Determine Resource Costs and Cost Avoidance.**

(a) There is always cost associated with complying with a requirement. This cost may range from minimal administrative efforts to the resource expenditures that



## **Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product, continued**

support full scale testing or the redesign of a large portion of an aircraft. However, there are also potential cost savings from compliance with a requirement. For example, compliance with a requirement may avoid aircraft damage or accidents and the associated costs to the manufacturer for investigating accidents. Compliance with the latest amendment of a requirement may also help a foreign authority certificate a product.

(b) When determining the impracticality of applying a requirement at the latest amendment level, only the incremental costs and safety benefits from complying with the existing certification basis should be considered.

(c) When evaluating the incremental cost, it may be beneficial for the applicant to compare the increase in cost to comply with the latest requirements to the cost to incorporate the same design feature in a new airplane. In many cases an estimate for the cost of incorporation in a new airplane is provided in the regulatory evaluation by the Administrator, which was presented when the corresponding regulation was first promulgated. Incremental costs of retrofit/incorporation on existing designs may be higher than that for production. Examples of costs may include but are not limited to:

(1) Costs: The accuracies of fleet size projections, utilization, etc. may be different than that experienced for derivative product designs and must be validated.

(a) Labor: Work carried out in the design, fabrication, inspection, operation or maintenance of a product for the purpose of incorporating or demonstrating compliance with a proposed action. Non-recurring labor requirements, including training, should be considered.

(b) Capital: Construction of new, modified or temporary facilities for design, production, tooling, training, or maintenance.

(c) Material: Cost associated with product materials, product components, inventory, kits, and spares.

(d) Operating Costs: Costs associated with fuel, oil, fees, and expendables.

(e) Revenue/Utility Loss: Costs resulting from earning/usage capability reductions from departure delays, product downtime, capability reductions of performance loss due to seats, cargo, range, or airport restrictions.

### **(2) Cost Avoidance:**

(a) Avoiding cost of accidents, including investigation of accidents, lawsuits, public relations activities, insurance, and lost revenue.

## **Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product, continued**

**(b) Foreign Certification:** Achieve a singular effort that would demonstrate compliance to the requirements of most certifying agencies, thus minimizing certification costs.

### **(7) Step 7: Document Conclusion.**

**(a)** Once the information from previous steps has been documented and reviewed, the applicant's position and rationale regarding practicality can be documented. Examples of possible positions would include but are not limited to:

**(1)** Compliance with the latest requirement is necessary. The applicant would pursue the change at the latest amendment level.

**(2)** Compliance with an amendment level between the existing certification basis and the latest amendment would adequately address the hazard at an acceptable cost, while meeting the latest amendment level would be impractical. The applicant would then propose the intermediate amendment level of the requirement.

**(3)** The increased level of safety is not commensurate with the increased costs associated with meeting the latest amendment instead of the existing certification basis. Therefore, the applicant would propose the existing certification basis.

**(4)** The results of this analysis were inconclusive. Further discussions with the FAA are warranted.

**NOTE:** This process may result in a required certification basis that renders the proposed modification economically not viable.

**2. EXAMPLES OF HOW TO CERTIFY CHANGED AIRCRAFT.** The following examples are for transport airplanes and illustrate the typical process an applicant follows. The process will be the same for all product types.

#### **a. Example 1: 14 CFR § 25.963 Fuel Tank Access Covers.**

**(1)** This change is part of a significant transport airplane change that increases passenger payload and gross weight by extending the fuselage 20 feet. To accommodate the higher design weights and increased braking requirements, and to reduce runway loading, the applicant will change the landing gear from a two-wheel to four-wheel configuration; this changes the debris scatter on the wing from the landing gear. The new model airplane will be required to comply with the latest applicable regulations based on the date of application.

**Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product, continued**

(2) The wing will be strengthened locally at the side of the body and at the attachment of engines and landing gear, but the applicant would not like to alter wing access panels and the fuel tank access covers. Although the applicant recognizes that the scatter pattern and impact loading on the wing from debris being thrown from the landing gear will change, he proposes that it would be impractical to redesign the fuel tank access covers.

**(3) Step 1: Identify the Regulatory Change Being Evaluated.**

(a) The existing certification basis of the airplane that is being changed is Part 25 prior to Amendment 25-69.

(b) Amendment 25-69 added the requirement that fuel tank access covers on transport category airplanes be designed to minimize penetration by likely foreign objects, and be fire resistant.

**(4) Step 2: Identify the Specific Hazard that the Regulation Addresses.**

Fuel tank access covers have failed in service due to impact with high-energy objects such as failed tire tread material and engine debris following engine failures. In one accident, debris from the runway impacted a fuel tank access cover, causing its failure and subsequent fire, which resulted in fatalities and loss of the airplane. Amendment 25-69 will ensure that all access covers on all fuel tanks are designed or located to minimize penetration by likely foreign objects, and are fire resistant.

**(5) Step 3: Review the History of the Consequences of the Hazard(s).**

Occurrences with injuries and with more than 10% deaths.

**(6) Step 4: Identify the Historical and Predicted Frequency of Each Consequence.**

(a) In 200 million departures of large jets:

(1) One occurrence with more than 10% deaths; and

(2) One occurrence with injuries.

(b) There is no reason to believe that the future rate of accidents will be significantly different than the historical record.

**(7) Step 5: Determine How Effective Full Compliance with the Latest Amendment of the Regulation Would Be at Addressing the Hazard.**

(a) Considerable potential for eliminating or avoiding the hazard.

## **Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product, continued**

(b) Compliance with Amendment 25-69 eliminates the hazard or provides a means to avoid the hazard completely for all probable or likely cases. However, it does not cover all situations or scenarios.

### **(8) Step 6: Determine Resource Costs and Cost Avoidance.**

#### **(a) Costs:**

(1) For a newly developed airplane, there would be minor increases in labor resulting from design and fabrication.

(2) There would be a negligible increase in costs related to materials, operating costs, and revenue utility loss.

#### **(b) Cost Avoidance:**

(1) There were two accidents in 200 million departures. The applicant believes that it will manufacture more than 2,000 of these airplanes or derivatives of these airplanes. These airplanes would average five flights a day. Therefore, statistically there will be accidents in the future if the hazard is not alleviated. Compliance will provide cost benefits related to avoiding lawsuits, accident investigations, and public relation costs.

(2) There are cost savings associated with meeting a single certification basis for FAA and foreign regulations.

(9) **Conclusion.** It is concluded that compliance with the latest regulation increases the level of safety at a minimal cost to the applicant. Based on the arguments and information presented by the applicant through the issue paper process, the Administrator determined that meeting the latest amendment would be practical.

### **b. Example 2: 14 CFR § 25.365 Pressurized Compartment Loads.**

(1) For the product change described in Example 1, the lengthened fuselage affects the size of the main deck passenger compartment and the lower center cargo compartment. The applicant plans to comply fully with the latest pressurized compartment loads, except for one interior partition for which the applicant believes compliance would be impractical.

(2) The applicant proposes to increase the length of the fuselage by installing fuselage plugs. This change affected the size of the main deck passenger compartment and the lower center cargo compartment.

### **(3) Step 1: Identify the Regulatory Change Being Evaluated.**

## **Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product, continued**

(a) The existing certification basis of the airplane that is being changed includes 14 CFR § 25.365 at Amendment 25-54. The initial release of 14 CFR § 25.365 required that the interior structure of passenger compartments be designed to withstand the effects of a sudden release of pressure through an opening resulting from the failure or penetration of an external door, window, or windshield panel, or from structural fatigue or penetration of the fuselage, unless shown to be extremely remote.

(b) Amendment 25-54 revised 14 CFR § 25.365 to require that the interior structure be designed for an opening resulting from penetration by a portion of an engine, an opening in any compartment of a size defined by 14 CFR § 25.365(e)(2), or the maximum opening caused by a failure not shown to be extremely improbable.

(c) Amendment 25-71 extended the regulation to all pressurized compartments, not just passenger compartments, and to the pressurization of unpressurized areas. The later regulation had previously been identified as an unsafe feature under 14 CFR § 21.21(b)(2).

**(4) Step 2: Identify the Specific Hazard that the Regulation Addresses.** The hazard is a catastrophic structure and/or system failure produced by a sudden release of pressure through an opening in any compartment in flight. This opening could be caused by an uncontained engine failure, an opening of a prescribed size due to the inadvertent opening of an external door in flight, or an opening caused by a failure not shown to be extremely improbable. The opening could be produced by an event that has yet to be identified.

### **(5) Step 3: Review the History of the Consequences of the Hazard(s).**

(a) Occurrences with injuries, less than 10% deaths, and more than 10% deaths.

### **(6) Step 4: Identify the Historical and Predicted Frequency of Each Consequence.**

(a) In 200 million departures of large jets:

(1) Two occurrences with more than 10% deaths;

(2) One occurrence with less than 10% deaths; and

(3) One occurrence with injuries.

(b) There is no reason to believe that the future rate of accidents will be significantly different than the historical record.

## **Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product, continued**

### **(7) Step 5: Determine How Effective Full Compliance with the Latest Amendment of the Regulation Would Be at Addressing the Hazard.**

(a) Fully effective in all cases. Compliance with Amendment 25-71 eliminates the hazard or provides a means to avoid the hazard completely.

(b) Considerable potential for eliminating or avoiding the hazard. Compliance with Amendment 25-54 eliminates the hazard or provides a means to avoid the hazard completely for all probable or likely cases, but it does not cover all situations or scenarios.

(c) Adequately deals with the hazard. Compliance with the original certification basis eliminates the hazard or provides a means to avoid the hazard completely in many cases. However, the hazard is not eliminated or avoided in all probable or likely cases. Usually this action only addresses a significant part of a larger or broader hazard.

(d) Design changes made to the proposed derivative airplane bring it nearly into compliance with 14 CFR § 25.365 at Amendment 25-71. Analyses show that one interior partition would fail when subjected to the pressure differential defined by the latest regulation. However, its failure would not have an impact on continued safe flight and landing. This is because none of the critical or essential systems are affected by failure of this partition, and its failure would not present a hazard to a crewmember. Design solutions were considered for this partition, including structural reinforcement and additional venting area, but all were found to require extensive redesign. With this design the applicant believes that most of the safety benefits have been achieved fully with Amendment 25-71.

### **(8) Step 6: Determine Resource Costs and Cost Avoidance.**

(a) Costs:

(1) For a newly developed airplane, there would be a considerable increase in costs related to labor and capital to comply with Amendment 25-71 instead of the original certification basis.

(2) There would be a negligible increase in costs related to materials, operating costs, and revenue utility loss.

(3) There would be savings in both labor and capital costs if compliance were shown to Amendment 25-54 instead of Amendment 25-71.

**Appendix 2. Procedure for Evaluating Impracticality of Applying Latest Requirements to a Changed Product, continued**

**(b) Cost Avoidance:**

**(1)** There were four accidents in 200 million departures. The applicant believes that it will manufacture more than 2,000 of these airplanes or derivatives of these airplanes. These airplanes would average five flights a day. Therefore, statistically there will be accidents in the future if the hazard is not alleviated. Compliance will provide cost benefits related to avoiding lawsuits, accident investigations, and public relation costs.

**(2)** There are cost savings associated with meeting a single certification basis for FAA and foreign regulations.

**(9) Step 7: Document Conclusion Regarding Practicality.** The design is in compliance with 14 CFR § 25.365 at Amendment 25-54 and nearly in full compliance to Amendment 25-71. The design would adequately address the hazard at an acceptable cost. Therefore, based on arguments of impracticality discussed in an issue paper, the Administrator accepts the applicant's proposal to comply with 14 CFR § 25.365 at Amendment 25-54.





### **Appendix 3. The Use of Service Experience in the Certification Process**

**1. INTRODUCTION.** Service experience may support the application of an earlier regulatory standard if, in conjunction with the applicable service experience and other compliance measures, the earlier standard provides a level of safety comparable to that provided by the latest requirements. The applicant must provide sufficient substantiation to allow the Administrator to make this determination. A statistical approach may be used, subject to the availability and relevance of data, but sound engineering judgment must be used. For service history to be acceptable, the data must be both sufficient and pertinent. The essentials of the process involve:

- a. A clear understanding of the requirement change and the purpose for the change;
- b. A determination based on detailed knowledge of the proposed design feature;
- c. The availability of pertinent and sufficient service experience data; and
- d. A comprehensive review of that service experience data.

**2. GUIDELINES.** The Issue Paper process would be used, and the applicant should provide documentation to support the following:

- a. The identification of the differences between the requirement in the existing basis and the requirement as amended, and the effect of the change in the requirement.
- b. A description as to what aspect(s) of the latest requirements the proposed changed product would not meet.
- c. Evidence showing that the proposed certification basis for the changed product, together with applicable service experience, provides a level of safety consistent with complying with the latest requirements.
- d. A description of the design feature and its intended function.
- e. Data for the product pertinent to the requirement.
  - (1) Service experience from such data sources as the following:
    - (a) Accident reports;
    - (b) Incident reports;
    - (c) Service bulletins;
    - (d) Airworthiness directives;
    - (e) Repairs;
    - (f) Modifications;

**Appendix 3. The Use of Service Experience in the Certification Process, continued**

- (g) Flight hours/cycles for fleet leader and total fleet;
- (h) World airline accident summary data;
- (i) Service difficulty reports;
- (j) National Transportation Safety Board reports; and
- (k) Warranty, repair and parts usage data.

(2) Show that the data presented represent all relevant service experience for the product, including the results of any operator surveys, and is comprehensive enough to be representative.

(3) Show that the service experience is relevant to the issue.

(4) Identification and evaluation of each of the main areas of concern with regard to:

- (a) Recurring and/or common failure modes;
- (b) Cause;
- (c) Probability, by qualitative reasoning; and
- (d) Measures already taken and their effects.

(5) Relevant data pertaining to aircraft of similar design and construction may be included.

(6) Evaluation of failure modes and consequences through analytical processes. The analytical processes should be supported by:

- (a) A review of previous test results; and
- (b) Additional detailed testing.

f. A conclusion that draws together the data and the rationale.

g. These guidelines are not intended to be limiting, either in setting required minimum elements or in precluding alternative forms of submission. Each case may be different, based on the particulars of the system being examined and the requirement to be addressed.

**Appendix 3. The Use of Service Experience in the Certification Process, continued****3. EXAMPLE: 14 CFR § 25.1141(f) TRANSPORT AIRPLANES.**

a. The following example, for transport airplanes (14 CFR § 25.1141(f) Auxiliary Power Unit (APU) Fuel Valve Position Indication System), illustrates the typical process an applicant follows. The process will be the same for all product types.

b. This example comes from a new generation model transport airplane where significant changes were made to the main airframe components, engines and systems, and APU. The baseline airplane has an extensive service history. The example shows how the use of service experience supports a finding that compliance with the latest regulation would not contribute materially to the level of safety, and that application of the existing certification basis (or earlier amendment) would be appropriate. The example is for significant derivatives of transport airplanes with extensive service history, and illustrates the process, following the guidelines in this appendix, but does not include the level of detail normally required.

(1) The differences between the regulation in the existing certification basis and the regulation as amended, and the effect of the change in the regulation. The existing certification basis of the airplane that is being changed is the initial release of Part 25. Amendment 25-40 added requirement 14 CFR § 25.1141(f), which mandates that power-assisted valves must have a means to indicate to the flight crew when the valve is in the fully open or closed position, or is moving between these positions.

(2) What aspect of the proposed changed product would not meet the latest regulations? The proposed APU fuel valve position indication system does not provide the flight crew with fuel valve position or transition indication and, therefore, does not comply with the requirements of 14 CFR § 25.1141(f).

(3) Evidence that the proposed certification basis for the changed product, together with applicable service experience of the existing design, provide a level of safety comparable to that intended by the latest regulation. The APU fuel shut-off valve and actuator are unchanged from those used on the current family of airplanes, and have been found to comply with the earlier Amendment 25-11 of 14 CFR § 25.1141(f). The existing fleet has achieved approximately (#) flights during which service experience of the existing design has been found to be acceptable. If one assumes a complete APU cycle, i.e., start-up and shutdown for each flight, the number of APU fuel shut-off valve operations would be over  $10^8$  cycles, which demonstrates that the valve successfully meets its intended function and complies with the intent of the regulation. In addition, the system design for the changed product incorporates features that increase the level of functionality and safety.

(4) A description of the design feature and its intended function. The fuel shut-off valve, actuator design, and operation is essentially unchanged; with the system design ensuring that the valve is monitored for proper cycling from closed to open at start. If the valve is not in the appropriate position (i.e., closed), then the APU start is terminated, an indication is displayed on the flight deck, and any further APU starts are prevented.

**Appendix 3. The Use of Service Experience in the Certification Process, continued**

Design improvements using the capability of the APU Electronic Control Unit (ECU) have been incorporated in this proposed product change. These design changes ensure that the fuel valve indication system will indicate failure of proper valve operation to the flight crew, but the system does not indicate valve position as required by 14 CFR § 25.1141(f).

(5) Data for the product pertinent to the regulation. An issue paper was coordinated, included data, or referenced reports, documenting relevant service experience that has been compiled from incident reports, fleet flight hour/cycle data, and maintenance records. The issue paper also discussed existing and proposed design details, failure modes and analyses showing to what extent the proposed airplane complies with the latest amendment of 14 CFR § 25.1141. Information is presented to support the applicant's argument that compliance with the latest amendment would not materially increase the level of safety. Comparative data pertaining to aircraft of similar design and construction are also presented.

(6) Conclusion, drawing together the data and rationale. The additional features incorporated in the APU fuel shut-off valve will provide a significant increase in safety to an existing design with satisfactory service experience. The applicant proposes that compliance with the latest amendment would not materially increase the level of safety, and that compliance with 14 CFR § 25.1141 at Amendment 25-11 would provide an acceptable level of safety for the proposed product change.

## Appendix G

### Changed Product Rule Matrix

<b>CPR Procedures and Concepts</b>	<b>Step in Process</b>	<b>We do this today</b>	<b>.....but with additional guidance</b>	<b>New Procedures</b>
<b>Identify the Change</b>	Step 1.	8110.4		
<b>Product Level Concept</b>			AC 21.101-1 8110.CPR	
<b>Identify if the Change is Substantial</b>	Step 2.	21.19		
<b>Use criteria in the rule to assess if change is or is not significant</b>	Step 4.			21.101 AC 21.101-1 8110.CPR
<b>-for excepted aircraft</b>				Yes
<b>-for “other” aircraft</b>				Yes
<b>Identify the affected area of the change</b>	Step 5	Yes	AC 21.101-1 8110.CPR	
<b>Apply the “doesn’t materially contribute” exception</b>	Step 6.	Yes	AC 21.101-1 8110.CPR	
<b>Apply the “impractical” exception</b>	Step 6.			AC 21.101-1 8110.CPR
<b>Apply Special Conditions</b>		21.16	AC 21.101-1 8110.CPR	
<b>Apply to type validation programs</b>		8110.TVP		
<b>Continuous Improvement Team</b>				To be established by Charter



## Appendix H

### Part 23 Aircraft Exercise

#### A. *Does Not Materially Contribute to the Level of Safety*

##### Small Airplane Example



- Aircraft manufacturer made application for new derivative model, constituting a *significant* product-level change
- Therefore, applicant must comply with regulations in effect on date of application
- Applicant proposes to install new aircraft engine fuel metering unit that incorporates two separate controls

CPR, 1.0

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- In this section we will illustrate the application of the *does not materially contribute to the level of safety* and the *impractical* exceptions to a part 23 aircraft.

##### Small Airplane Example, cont.



- Latest regulation: power or thrust control
  - Airplane capable of safe flight and landing if control separates at engine fuel metering device
- Full compliance
  - Add spring type device to engine fuel metering unit
  - Possible requires engine STC or amended TC

CPR, 1.0

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### Small Airplane Example, cont.



#### ➤ Manufacturer's alternate design:

- Add washer with large bearing surface to the end fitting of each control to extend the life of the control
- Test design to establish service life
- Place life-limits on controls

CPR, 1.0

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- The applicant recognizes that the proposed design will not comply with amendment 23-43. Citing the compensating design features listed above, the applicant has proposed that compliance with the latest requirements *would not materially contribute to the product's level of safety.*
- **Step 1**, Identify the regulatory change being evaluated.

### Part 23 Example, Step 1



#### ➤ Identify regulatory change being evaluated

- Specific rule, §23.1143, Engine controls
- Amendment level of the existing certification basis for the rule, 23-17
- Latest amendment level for this rule, 23-43; proposed amendment, 23-29

CPR, 1.0

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**Part 23 Example, Step 1, cont.****➤ 23.1143(g)**

- **For reciprocating single-engine airplanes, each power or thrust control must be designed so that if the control separates at the engine fuel metering device, the airplane is capable of continued safe flight and landing**

CPR, 1.0

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- This slide shows the most current amendment level of the regulation under consideration.

- **Step 2, Identify the specific hazard the regulation addresses.**

**Part 23 Example, Step 2****➤ Identify the specific hazard of 23.1143(g)**

- **Loss of control of aircraft if control separates at engine fuel metering device**
- **Airplane is not capable of continued safe flight and landing**

CPR, 1.0

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- The specific hazard we're addressing became part of §23.1143 at Amendment 23-43 in May 1993, which added paragraph (g) to 23.1143.

- **Step 3**, Review the consequences of the hazard(s).

### Part 23 Example, Step 3



#### ➤ Review consequences of hazard(s)

- Data for example gathered and used in preamble to amendment-level change
- Accidents grouped as follows:
  - ✓ Accidents resulting in minor injuries
  - ✓ Accidents resulting in serious injuries
  - ✓ Accidents resulting in fatalities

CPR, 1.0

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- **Step 4**, Identify the historical and predicted frequencies of each consequence.

### Part 23 Example, Step 4



#### ➤ Identify historical and predicted frequency of each consequence


- Historical – 42 total accidents:
  - ✓ 31 occurrences resulted in minor injury
  - ✓ 10 occurrences resulted in serious injury
  - ✓ 1 occurrence resulted in a fatality
- Predicted - Assume same as historical

CPR, 1.0

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- **Step 5**, Determine how effective full compliance would be at addressing hazard of §23.1143.

### Part 23 Example, Step 5




- **Determine how effective full compliance would be at addressing hazard of 23.1143(g)**
  - Amendment 23-43, fully effective in all cases
  - Amendment 23-29, addresses all known engine control hazards except those identified in paragraph (g)

CPR, 1.0 346

- **Step 6**, Define the difference between the changed product's level of safety and the level established by the latest amendment.

### Part 23 Example, Step 6



- **Full compliance with 23.1143(g) (amndt. 23-43) requires addition of spring type device to engine fuel metering unit**

CPR, 1.0 347

- Background of design change:
  - The changed product incorporated features that were required to address an unsafe condition that was identified in an **AD for a similar product**.
  - However, when the **latest amendment** was promulgated to address the unsafe condition, the level of safety was set at a **higher level than that of the AD**.

### Part 23 Example, Step 6, cont.



#### ➤ Manufacturer's alternate design:

- Add washer with large bearing surface to the end fitting of each control to extend the life of the control
- Test design to establish service life
- Life-limit controls in maintenance manual

- **Step 7, Make and document decision.**

### Part 23 Example, Step 7



#### ➤ **Make and document decision**

- **Proposed design exceeds requirements of amendment 23-29, the next applicable level below 23-43**
- **Not in compliance with 23-43**
- ***Does not address hazard*, loss of control of aircraft due to the control separation at the engine fuel metering device**

CPR, 1.0

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### Part 23 Example, Step 7, cont.

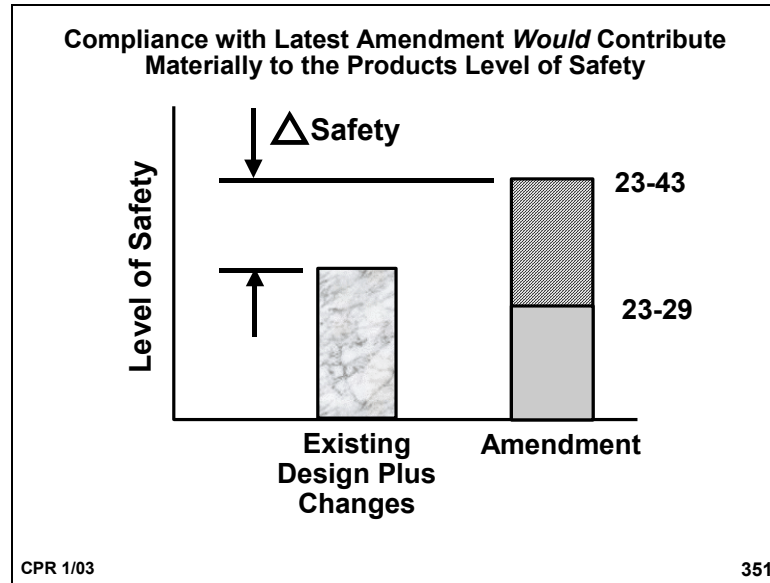


#### ➤ **Make and document decision, cont.**

- **FAA determined that compliance with latest amendment (23-43) **WOULD** contribute materially to the level of safety of the product**
- **FAA documented the decision in an issue paper**

CPR, 1.0

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## B. *Impractical*

- Once the FAA determined that compliance with the latest requirement **would** materially contribute to the level of safety, the applicant chose to pursue the *impractical* exception.
- So now we're at the next step for *impractical*, which is step 6 (remember the first 5 steps are the same and don't need to be repeated.)

- **Step 6**, Determine resource cost.

### Part 23 Example, Step 6




➤ **Determine resource cost**

- Compliance with §23.1143(g) requires addition of a spring device to engine fuel-metering control
- Cost of spring device relatively small
- Installation approval cost is very high – engine STC or amended TC required

CPR, 1.0 352

- **Step 7**, Make and document decision.

### Part 23 Example, Step 7



➤ **Make and document decision**

- Proposed design exceeds requirements of amendment 23-29
- Compliance with latest amendment (23-43) would contribute materially to the level of safety
- Proposed design *not* in strict compliance with amendment 23-43

CPR, 1.0 353

## Part 23 Example, Step 7



### ➤ Make and document decision, cont.

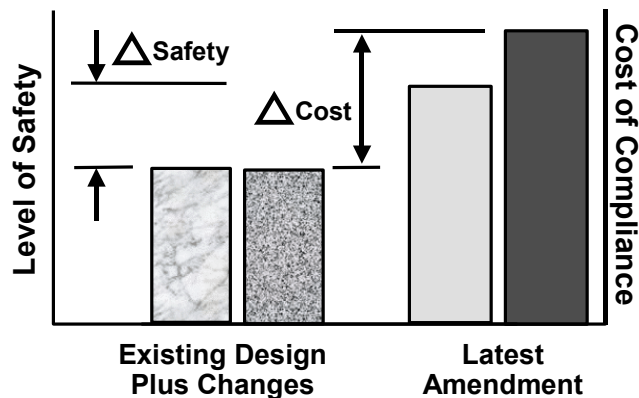
- FAA determined applicant demonstrated that additional safety benefit achieved by *full* compliance *not* commensurate with the added resource cost
- Decision coordinated with the Small Airplane Directorate Standard Staff and documented in issue paper
- Product given credit for compliance to amendment 23-29 on TCDS

CPR, 1.0

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- The certified design was defined in the drawing package.

### Compliance with Latest Amendment Would Be *Impractical*



CPR, 1.0

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## Appendix I

### Course Evaluation Forms

If you are taking this course in a **traditional classroom setting**, your instructor will give you directions on when to complete the course evaluation. When you have completed the evaluation, return it to your instructor. **The evaluation form to use starts on the next page (I-3).**

If you are **taking this course via IVT/ATN** and you are logged on to a keypad, you will be asked to complete the course evaluation by using the Viewer Response System keypad. Your instructor will provide directions on how and when to complete the course evaluation. There are also some open-ended questions that you can respond to (in writing), and these can be faxed back to the ATN studio. **The evaluation form starts on page I-5.**

If you are completing the course **via self-study video**, please complete the form and return to your Air Training Manager (ATM). Please note that to get credit in your training history for watching the video, you **MUST** return the evaluation form. **The evaluation form starts on page I-5.**

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## CPR Implementation Classroom Training

Course Number: 25950

### End-of-Course Evaluation

We want your candid opinion on the course you just completed. Your feedback will help us provide the best possible products and services. Once completed, please return this evaluation to the course instructor. Thank you.

**Please rate this course on the following factors:**

	Highly Satisfactory	Satisfactory	Somewhat Satisfactory	Slightly Satisfactory	Not At All Satisfactory	N/A
Length of course						
Dept of information						
Pace of training						
Clarity of objectives						
Relevance to your job						
Sequence of content						
Opportunity to practice						
Suitability of course material						
Effectiveness of instructors						
Equipment						
Facilities						
<b>Overall Quality</b>						

If any area needs improvement, what specific change(s) would you suggest?

**Rate how well the training met your needs:**

Excellent	Good	Average	Fair	Poor	N/A

If you selected "Fair" or "Poor", please explain.

**Comments:**

Suggestion:

Complaint:

Compliment:

Other:

Class Date \_\_\_\_\_ Class Location \_\_\_\_\_

Please return this evaluation to the course instructor. **THANK YOU**

IVT (#62829) or Self-Study Video (#25829)  
Course Evaluation Form

Changed Product Rule Implementation  
**May & June 2003**

We want your candid opinion on the training you just completed. Your feedback will help us to provide the best possible products and services. Please respond to the questions below. Note that not all questions may be applicable to your training. *If you have completed via IVT/ATN, your instructor will prompt you when to enter your answers in your keypad. If you have completed the video option, complete this form manually and return to your ATM. You must complete and return this evaluation form to your ATM in order to get credit for the video option.*

A = Highly Satisfactory   B = Satisfactory   C = Somewhat Satisfactory  
D = Not at all Satisfactory   E = Not applicable

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1. Clarity of objectives	A	B	C	D	E
2. Relevance of content to your job	A	B	C	D	E
3. Relevance of exercises to your job	A	B	C	D	E
4. Effectiveness of presentation of content	A	B	C	D	E
5. Quality of feedback	A	B	C	D	E
6. Quality of instructor/student communication	A	B	C	D	E
7. Supervisor support in course completion	A	B	C	D	E
8. Overall quality of the course	A	B	C	D	E

**CPR Implementation  
(IVT #62829, Self-Study #25829)**

**May and June 2003**

(This page is optional: complete manually)

**What information was most useful to you and why?**

**What information was least useful to you and why?**

**Additional comments:**

If completing this page after participating in the **live ATN broadcast**, please fax this sheet to the ATN studio at 405 954-0317.

If completing after **watching the video**, send to your AIR Training Manager (ATM).